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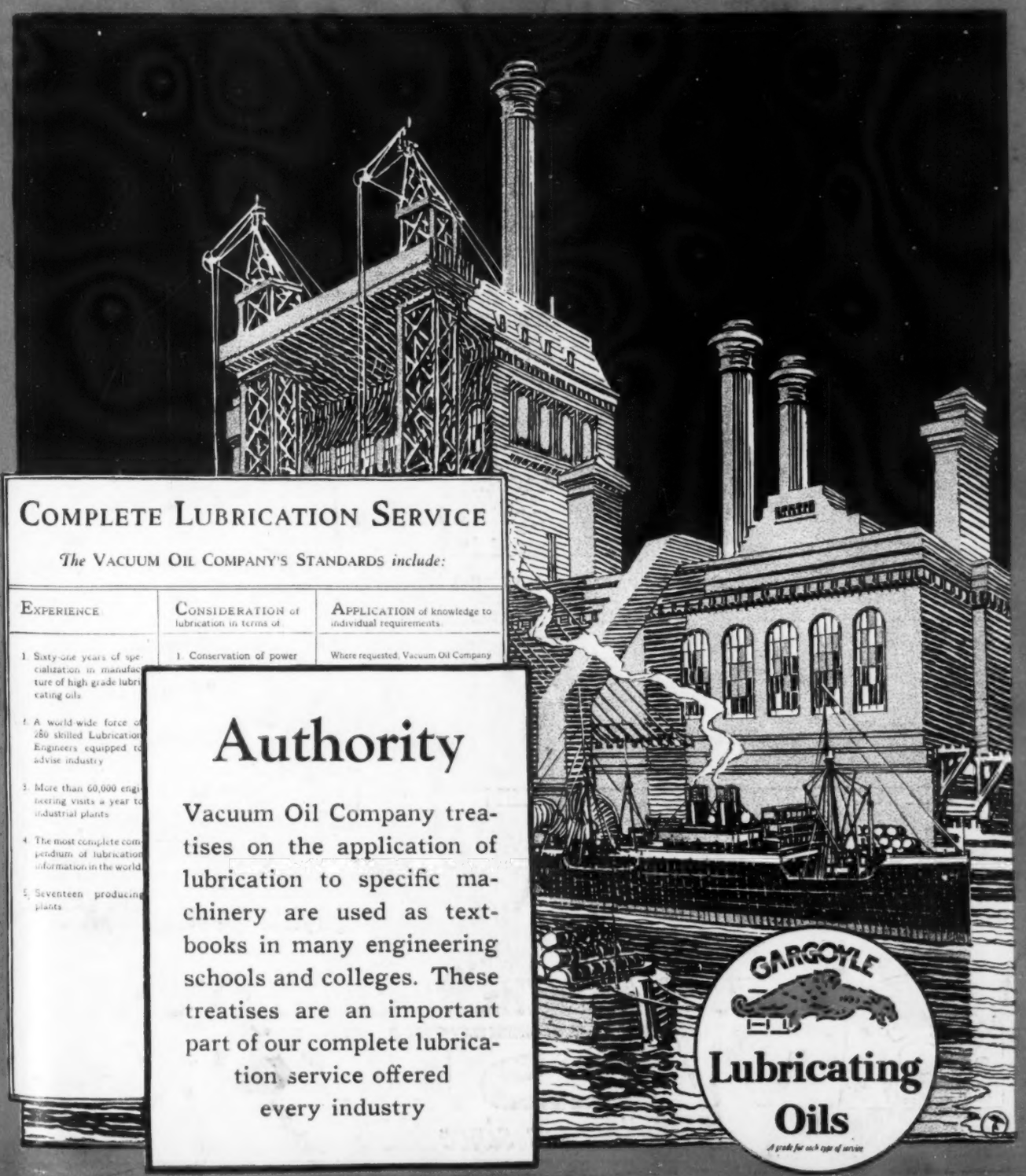
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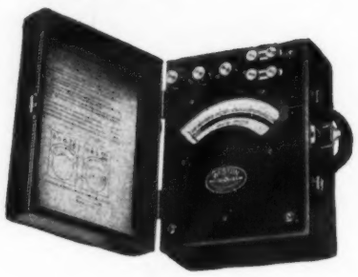

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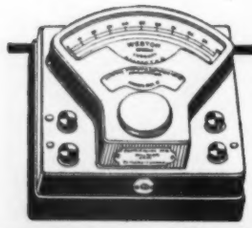

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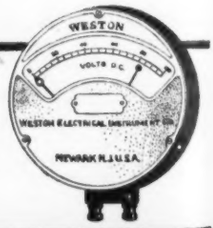

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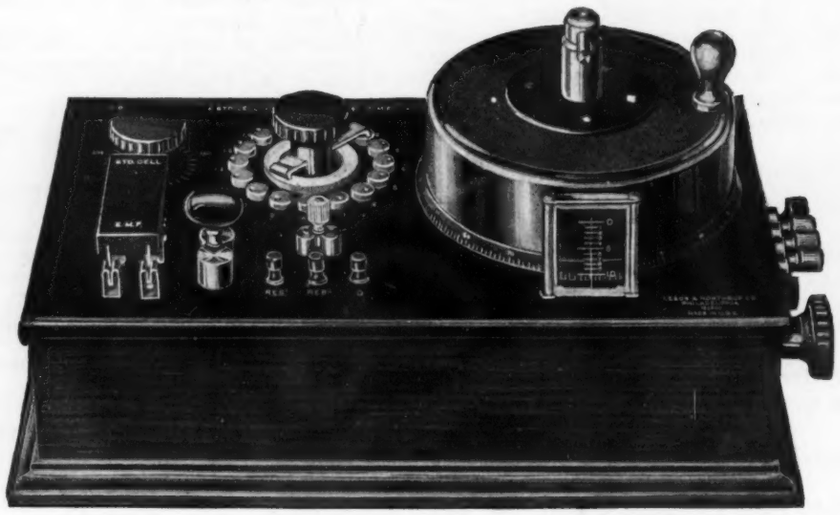

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Electrical World

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W. H. ONKEN, JR.

Editor

VOLUME 89 — *New York, Saturday, February 26, 1927* — NUMBER 9

Administration Policy Is Needed for Muscle Shoals and Boulder Dam

THE day is fast approaching when the Sixty-ninth Congress will pass automatically into the limbo of forgotten things. And well it may. So far as the electrical industry is concerned, it has done nothing constructive. The Congress still has a few days in which to do something, and in that time many things are possible but few probable. Muscle Shoals, Boulder Canyon Dam and the St. Lawrence are likely to remain as they are—topics for acrimonious debate and conversation—until the Seventieth Congress assembles next December. Meanwhile the country has before it one of the best evidences of the inability of government to function in any but a law-making capacity. People there are who delude themselves with the belief that government is an excellent and efficient operator. Politicians prate about government operation of Muscle Shoals and Boulder Canyon Dam, for example, and yet for years Congress has been unable to decide even on what to do with Muscle Shoals. Could it do a better job as an operator?

Several congressional commissions have already investigated and reported on the Tennessee River project, and yet the Senate committee on agriculture proposes still another investigation just as Congress is about to adjourn. Surely, with such evidences of congressional incompetency, it is time the Coolidge administration asserted itself. The Seventieth Congress ought not to be permitted to wallow about as the Congress just ending has done. Some solution should be suggested in these situations involving water power, even though water power be not the main issue. Between March and next December the administration ought to determine on some definite policy regarding Muscle Shoals, for example, as that issue has been longest in the public mind. That policy might be embodied in a bill or bills to be introduced into the next Congress and whose very nature ought to be such as to command not only administration but general public backing as well. The country has shown too great tolerance toward the present "dog-in-the-manger" policy. It is time the dog were chased.

Order in Radio Broadcasting

DEMAND by radio listeners for some order in broadcasting has brought about quick action by Congress, and the radio industry will operate in future under commission regulation. The Secretary of Commerce and the five commissioners to be appointed by the President will have no easy task. They must classify stations, determine their locations, prescribe the nature of their service, and in addition decide upon the wave bands, power and regulatory apparatus. Other features of the bill are also very detailed, and the new commission must include the most competent men available if satisfactory decisions are to be made.

The commercial aspects of broadcasting even now are complicated and no one can measure future developments. Entertainment features now lead, but there may be public service and communication features of vital importance in prospect. The light and power industry, for example, is coming to depend on radio to operate widespread power systems by remote control of relays, and also to rely upon radio as the normal means for giving operating orders. The railroads have done considerable experimenting with radio also, and the development of train-control systems and better radio systems may result in making radio an essential element of railroad transportation. Exclusive use of wave bands for some of these purposes should take precedence over allocation of wave bands for entertainment only, but no one can say yet whether short waves, medium waves or long waves will produce best results in these applications. The commission will be called upon to exercise very good judgment in order to avoid handicapping developments in the art through making hard and fast rulings based on present practices.

Let Common Sense Decide

POLITICAL agitation over Maine water-power policies reached a new climax last week when former Governor Pinchot of Pennsylvania assailed the public utility industry in unrestrained speeches at Augusta and Portland, joining hands with former Governor Baxter in attacking superpower development and prescribing the thoroughly discredited "giant power" scheme as the regimen for national economic salvation. Just what connection the chimerical Pinchot plan has with the proposal to permit surplus hydro-electric power exportation from Maine under commission regulation was not made clear, but the visit of the ex-Governor to the Pine Tree State raised enough verbal dust to bewilder not a few members of the Legislature now sitting at Augusta, and as a result the fate of proposed legislation to rid Maine of the costly inhibitions of the Fernald non-exportation law hangs in the balance.

It is unfortunate that questions of this kind are turned into political footballs by ambitious aspirants to public office, but since exploitation of this kind seems bound to endure pending a transformation of human nature, the only course for the utility industry is to bring out the truth with all the power at its command. This it is trying to do. The fallacies of "giant power" were comprehensively explained by W. S. Murray last week before the Economic Club of Portland immediately following an address before the same body by Mr. Pinchot, and President W. S. Wyman of the Central Maine Power Company has been vigorously setting forth the necessity for legislation which will enable Maine to regain some of its lost prestige and profit by adopting progressive policies in respect to water-power exportation. On the system of this company alone more than half a million dollars' worth of surplus water power now runs to waste annually as a result of the obstructive Fernald law, according to the company's

engineers, and it has been pointed out that the ability of the company to develop more power to serve its territory more effectively, to reach more rural customers and to reduce its rates depends in no small degree upon the passage of legislation which will enable the surplus power of this and other companies to be marketed under proper state supervision.

The time has come for Maine to revise its policies with respect to water-power exportation, and if common sense is allowed to decide the issue without reference to political balderdash and mud slinging against an industry whose fundamental ideal is public service, an intelligent solution of the problem cannot but be reached.

The Leagues—Their Status in the Industry

WHILE electrical men are waiting for the reorganization of the Society for Electrical Development, a good deal of thought is being given to the status of the local leagues in the industry. It is the hope and expectation that the S. E. D. will be re-established with a working tie-in with the four national associations of the power companies, manufacturers, jobbers and contractor-dealers, so that it will become the recognized official service agency of the electrical industry in matter of co-operative market development and publicity. What will be its relation with the leagues?

When the league movement began to quicken some six years or so ago the society gave aid. This was its natural province. And with the help of the good work done by the S. E. D. in holding the annual league conferences and in its field service to leagues, the number of leagues has now grown to nearly 150 and the scope and usefulness of many of them has been greatly increased. But the leagues have never been entirely satisfied with their relationship to the society. They have set up a league council to advise the society in its league work, but there has been no control through representation on the board of directors, and therefore no assurance of permanency. In short, the leagues have not had the opportunity to participate either in the management or the support of their accepted national service headquarters. And though they have been highly appreciative of the benefits they have received, particularly in the outstanding work that has been done for them by Kenneth McIntyre, the whole situation has not set well.

The men behind the leagues are today for the most part the leading electrical men of the localities. Central-station support and leadership are vital in league work, and some leagues are undoubtedly dominated by the power companies; but many leagues are truly representative of the best thought of all branches of the industry locally. As such the leagues are bound to exert an increasing influence in electrical affairs in the years ahead, and opinion is fast crystallizing in these leagues that their relationship with the S. E. D. should be more democratic.

These suggestions have been made: (1) That in the realignment the full membership of all recognized leagues should compose the membership of the Society for Electrical Development; (2) that the leagues in their annual conferences should elect, say, one-third of the directors of the society; (3) that the finances of the society should come in national funds from the power companies and the manufacturers and in local funds from the leagues, a moderate amount in proportion to membership, and (4) to make this relationship more clear that the society might well be renamed the "National Electrical League." The idea is appealing. Certainly the status of the leagues should be well defined. And the leagues should be well knit into the organization structure of the industry.

One Form of Price Competition

MANUFACTURERS are prone to believe only too readily that their competitors are cutting prices when some other cause is directly contributing to the loss of business. An offhand assumption that business was secured by price cutting not only disorganizes the industry but, if permitted to take root, undermines the whole commercial structure. For example, in one case a manufacturer's agent was losing business consistently to a competitor. The agent's cry was always for lower prices to meet the competition, and the fortunate bidder was each time taken aback when he learned of the lower and lower prices quoted against him; but although he did not lower his prices, he got the business. The agent continued to ask for lower prices till finally the manufacturer who was losing the business decided to make a very drastic cut in price. As even on this basis the order was not secured, the manufacturer who lost the business decided to get directly to the bottom of the situation. Investigation proved that the agent was *persona non grata* to the buyer, and the only result of his competition was to demoralize the situation. A change in representation soon remedied this defect.

Greater confidence in the policies of a competitor and a rigid adherence to a soundly established policy will prevent the breeding of much discontent. The upbuilding of a strong industry will be accomplished only under a system of confidence, fair dealing and the maintenance of a true course set by strong merchandising principles.

Service Paramount in Interconnection

IN THE opinion of Alex Dow, financial and policy elements are of primary importance in interconnections. He is a firm believer in building self-sufficient and self-sustaining generating areas and contends that interconnection has its chief commercial advantage in making possible mutual assistance in giving service when this assistance is necessary. Intercompany ties should be made on the policy of common good to all utilities concerned and primarily should serve as added guarantees to customer service.

This plan of interconnection leads to the development of interconnections in the form of tie lines between power stations or between substations at load centers. It does not involve continuous operation on an interconnected basis. Most of the tie lines are for emergency or temporary use only and therefore represent a capital investment to provide reserve opportunities to give service. They may be said to result from the cost balance of building a local service reserve as compared with using an interconnection reserve.

The principle of self-sustaining and self-contained generating areas is sound, but interconnection as a complete possibility is more than an emergency or temporary tie between these areas. Best and cheapest

service to customers is the goal of all utilities in a large service territory. As the industry develops neighboring utilities approach each other at several service points, and there will eventually result a network of transmission and distribution lines over the whole region, even though several utilities may be involved. In such a development the full benefits of interconnection will not be secured by using bulk-power tie lines between generating areas. From a service standpoint interconnection should make possible the best and cheapest service to each load. This is accomplished by having several service supplies to the load from several generating sources. From this standpoint interconnection developments should be based on the location of loads and service requirements in load areas and will require a network of comparatively light tie lines between utility systems as contrasted with a few bulk-power tie lines.

A long-time perspective on the growth of the utility business is required to develop interconnections fully, but present-day connections must necessarily take into consideration present-day economics and engineering. The article by Mr. Dow in this issue is replete with the sound thinking of a leading executive of the industry and should serve to guide the industry in the development of interconnections, especially in territories with only steam generating stations.

Servicing Contract Might Solve Appliance Maintenance Problem

SERVICING has been a bugaboo to some utility men ever since domestic electric appliances were introduced. How to meet the problem has been the moot point. It is not so much a question of the first year as it is of the years to follow. Some commercial managers feel that they can dodge the issue and shift the responsibility to the manufacturer, but they will find that customer relations are so intimately tied up with the satisfactory operation of appliances in the home that they will have to take a different attitude. The whole central-station industry has grown up on the basis of having the domestic customer look to the power company whenever anything goes wrong with his lamps or with an appliance. This is as it should be, and the situation could not be changed even if a change were desirable. Why not, then, squarely face the issue and find a solution before a chaotic condition arises and some domestic application is discredited because of lack of proper servicing?

The progressive radio dealer has solved his servicing problem by entering into a contract with his customer whereby the dealer's service man makes a routine inspection call once a month, for which the customer pays a flat amount per year, usually about $12. Herein very probably lies the solution to the domestic-appliance servicing problem. The annual charge would provide only for a general inspection, oiling, testing, adjusting, etc. Any major repairs, replacements or overhauling would be made at the expense of the customer, except as covered by the manufacturer's guarantee. Under this plan the customer's equipment would not be allowed to get into a run-down mechanical condition. Large repair bills would be forestalled, the customer would receive satisfaction from his appliance, and the power company would be put to little if any expense on account of servicing.

Steam-Electric Generation on the Pacific Coast

HYDRO-ELECTRIC construction on the Pacific Coast appears to be entering a slowing-down period because of the two important factors that are militating against water power in favor of steam. On the one hand are hampering restrictions which are tending to increase the cost of hydraulic construction, if not to make it impracticable altogether in some cases, and on the other hand is the decreasing cost of steam power produced by large units of high economy. At the present time there is probably no large load center on the Pacific Coast where steam-generated power cannot be produced cheaper with existing fuels by local units of large capacity than it can be by distant hydro-electric stations.

The recent Herminghaus case in California, in which the Supreme Court sustained an injunction against the Southern California Edison Company preventing it from storing certain important waters in the San Joaquin watershed, will have a far-reaching effect upon future hydro-electric development in that state unless the water law of California is amended to restrict riparian owners to a "reasonable use" of water, under the doctrine of riparian rights. In the Herminghaus case the Southern California Edison Company must resort to condemnation of certain lands before it can make full use of a large investment in storage facilities. This expense is naturally chargeable against the chain of plants affected and must therefore appear in the cost of power.

Another case in point is the necessity for the construction of an afterbay reservoir below the recently completed Balch plant of the San Joaquin Light & Power Corporation to maintain the normal flow of the North Fork of the Kings River. The situation in California is not hopeless, however, as irrigation districts and municipal water projects are affected in the same manner as the power companies, and a movement is now on foot to get the situation straightened out.

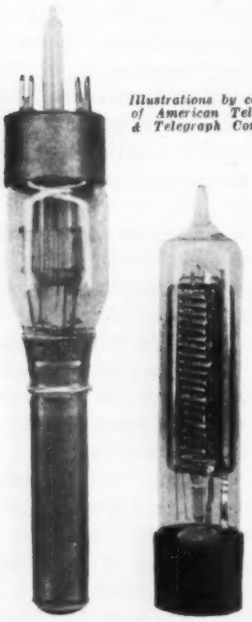
Oregon and Washington also are not without their troubles. A bill introduced at this year's session of the Oregon Legislature proposed to tax hydro-electric plants 50 cents per kilowatt per year of installed capacity. Fortunately the measure was defeated. A great many of the plants constructed in both Oregon and Washington are situated on salmon streams and it is necessary to erect fishways at considerable expense. Moreover, a large proportion of the water-power plants in these states are within national forest reserves, and often the cost of complying with the government's restrictions is a fair proportion of the total cost of the plant itself.

These and other factors are tending to increase the cost of hydro-electric construction in the West, while large units and higher efficiencies are bringing down unit capital costs and the cost of power produced by steam plants. There is already a major steam-plant construction program under way in southern California, and it is not unlikely that the next few years will see a marked change in the situation which has obtained in the West for years, with steam construction coming to the front and water power taking a less prominent place. It is also interesting to note that Congress continues to fumble with the Colorado while steam power continues to come into the economic picture.

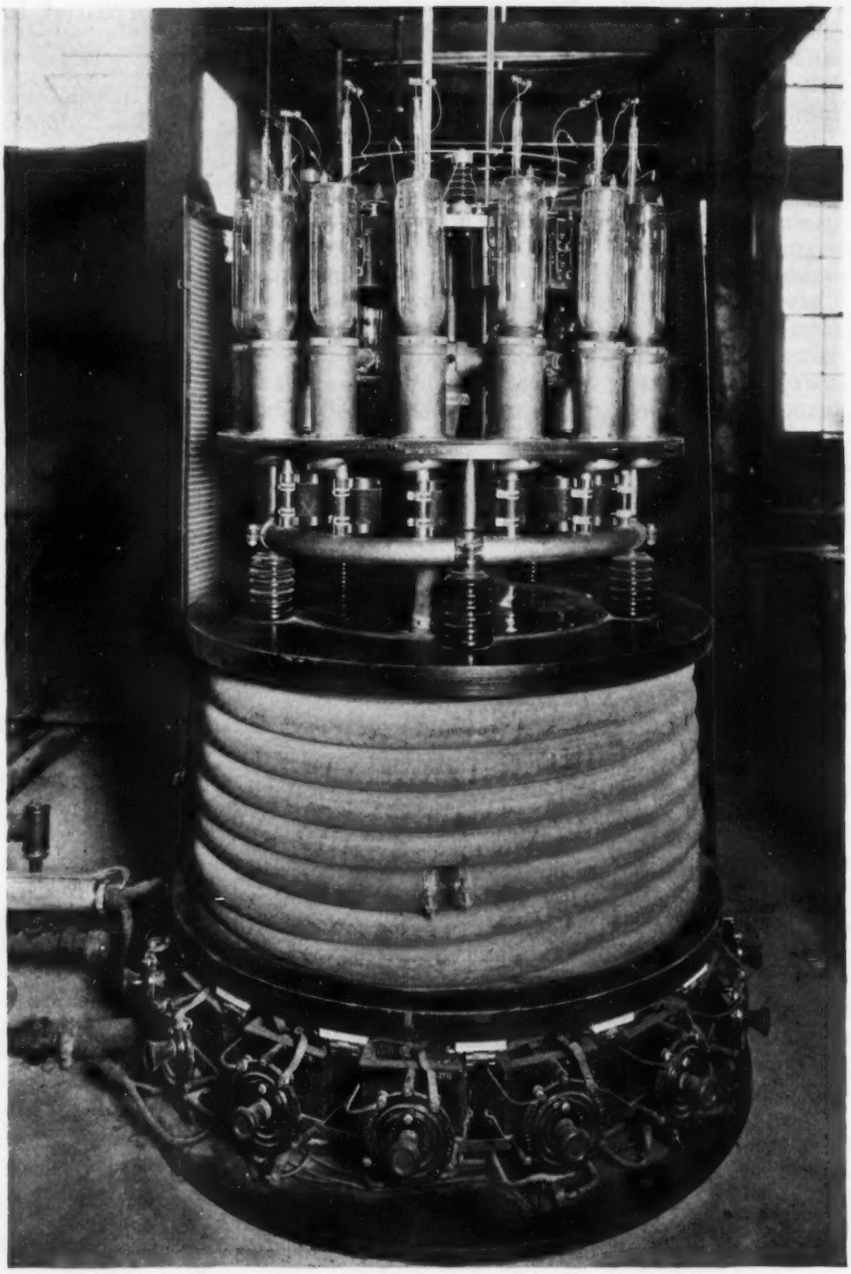
Some Equipment Used in Transatlantic Radio Telephony

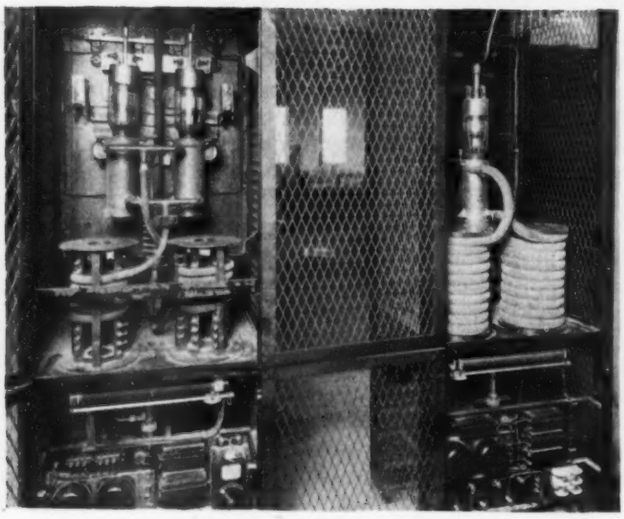
CONTRASTED here are the transatlantic vacuum tube of 1927 and that of 1915. The former, although very little larger than the original tube, is 400 times as powerful. The circular bank of water-cooled power amplifier tubes contains fifteen such units for the transatlantic radio-telephone service.

An intermediate amplifier group for raising the level of the voice currents from an initial 50 watts to 15 kw. is shown in part at the lower left, while the lower right view gives a close-up picture of the high-voltage rectifier equipment installed at the Rocky Point transmitting station. There are twelve two-electrode tubes in all, two in parallel for each six phases supplied by the transformer.. Each of the tubes is rated at 20 kw. with a plate current of about 2 amp. and a filament current of 41 amp. supplied by 22 volts, alternating current.



Illustrations by courtesy of American Telephone & Telegraph Company.





Seattle's New Street Lighting

Many Advantages Claimed for Multiple System that Will Replace All Series Circuits—Cost Estimates for Changing Installation—Lamp Types on Trial

By C. MAYNARD TURNER
Assistant Engineer State of Washington Department of Public Works, Olympia, Wash.

OVERLOADED circuits and the hazard of high-voltage series circuits have led the lighting department of the city of Seattle to take the first step in a program that will ultimately convert all series street-lighting circuits in Seattle to a multiple system developed by engineers of the department.

Because of rapid growth of the city the point has been reached where it is necessary either to split the present circuits, install new regulators and run new wires in many parts of the city, or to install a different system that will alleviate this condition. As several of the stations are fully loaded or have no room for additional equipment, the multiple circuit has been found to be the most economical method of handling the situation. The series system now has between 11,000 and 12,000 lamps in its circuits exclusive of an ornamental system of nearly 10,000 lamps fed from multiple feeders.

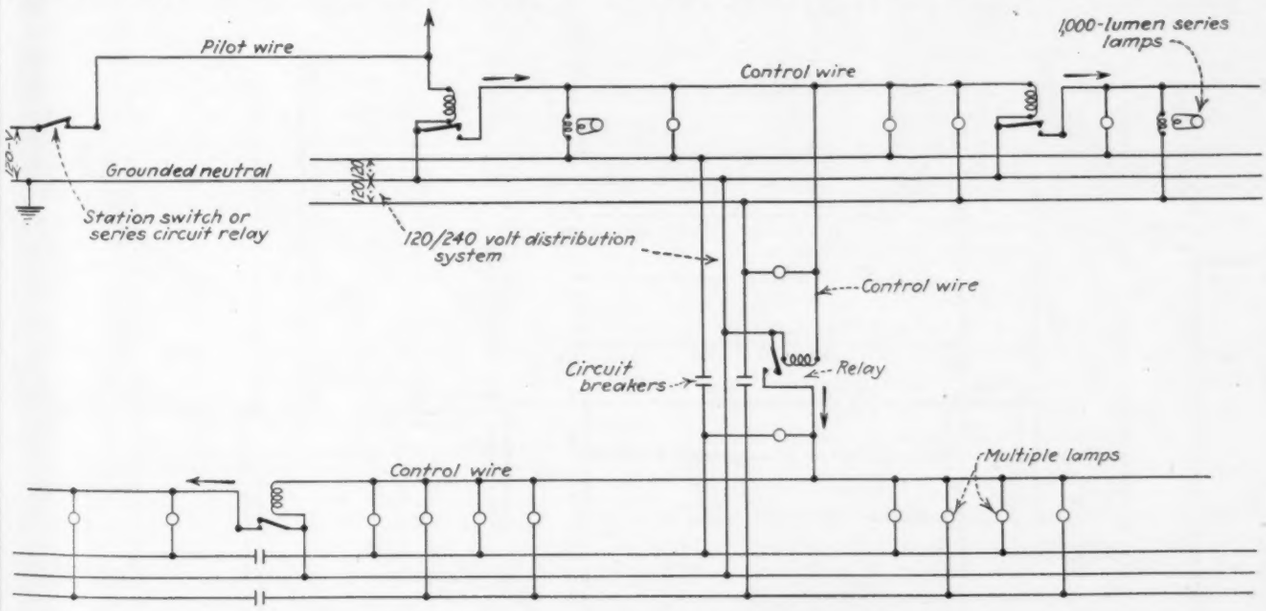


FIG. 1—CONTROL FOR SEATTLE MULTIPLE STREET-LIGHTING SYSTEM
When contacts are open, the relays are energized through the lamps. When closed, the lamps are lighted across the distribution system.

SEATTLE MULTIPLE SYSTEM

The Seattle multiple circuit differs from other street-lighting systems in that no circuit-closing relay is necessary to re-energize the control wire. It is also distinctive in that no additional wires other than the existing distribution system and the control wire are necessary to operate more than one lamp from each relay. A pilot wire is run from the stations to the first controlling relay or relays. These master relays are connected between the pilot wire and the neutral of the distribution system and are energized during the day to keep the contacts open. From the master relays control wires are run to operate each succeeding relay, as shown in Fig. 1. It will be noted that the control wire is used as the return wire from the lamps to the neutral when the relay contacts are closed and as the control wire for the relay switches when the contacts are open. By using this method one lamp or several lamps can be controlled from one relay switch without running additional wire. No additional unit is necessary to re-energize the control wire, because this function is performed at each existing relay.

Theoretically every light in the city, regardless of the number, may be operated from one switch and one pilot wire. However, it is practicable to sectionalize the city, using the stations as centers, and further to sectionalize these districts into a number, depending upon the locality of the station and the number of lamps. Fig. 2 shows part of a section operated by one pilot wire. As fast as the circuits can be changed this section will be increased in size. Where it is desired to install a group of lamps beyond a loaded series circuit before it is economical to change over the circuit, the

TABLE I—COST OF CHANGING OVER SMALL SECTION FROM SERIES TO MULTIPLE SYSTEM USING EITHER MULTIPLE OR SERIES LAMPS

	Multiple Lamp*	Series Lamp with Transformer
188 multiple lamps, 75 watt	$80.84	.....
Five multiple lamps, 300 watt	12.00	$12.00
Relays	420.00	420.00
Transformers	.....	1,598.00
Miscellaneous material	660.02	660.02
Total cost of material	$1,172.86	$2,690.02
Material reclaimed	693.86	637.46
Net cost of material	$479.00	$2,052.56
Labor (including truck)	1,270.00	1,470.76
Total cost	$1,749.00	$3,523.32
Cost per lamp	$9.06	$18.25

*Estimated. Figures for the series lamp installation are actual costs.

multiple system may be used by placing a series contact-opening relay in the existing series loop.

The relay switches used for such service must have trouble-proof contacts and coil, must be positive acting, must be compact and light and must require very little power. A year was spent developing a relay switch that would be satisfactory for this kind of service. Several methods of actuating the relays received trials by manufacturers interested in the development of such a device. The bad feature, common to nearly all switches submitted, was an unreasonable power consumption. The relays developed by the city's engineers in co-operation with a local manufacturer consume approximately 1.25 watts each, as against from 4 to 15 watts for the switches submitted by other companies.

Two types of contacts were tested, metallic and mercury. Tests run on an open mercury contact proved that it had many undesirable features, its liquid characteristics and oxidation being two of them. The city is now trying on its lines the metallic and the inclosed mercury types. The metallic contact relay switch is inclosed in a water-tight aluminum box and is so small that its presence on a pole or arm is hardly noticeable. (See Fig. 3). Radio interference, due to vibration of the relay, is taken care of in the manufacture. This unit is proving to be the more satisfactory of the two types installed.

CHANGING OVER SYSTEM

The Seattle multiple system was designed to operate on a distribution network of 2,300/120/240 volts grounded secondary neutral, with transformer banks separated by means of breakers. In converting the old series lighting system to multiple, the series wire for a small section is tied through and lowered to the secondary arm, since it is of secondary voltage. The relays and lamps (and transformers, where such are used) are then connected. By working on small sections of the circuit no lights are out at night during the

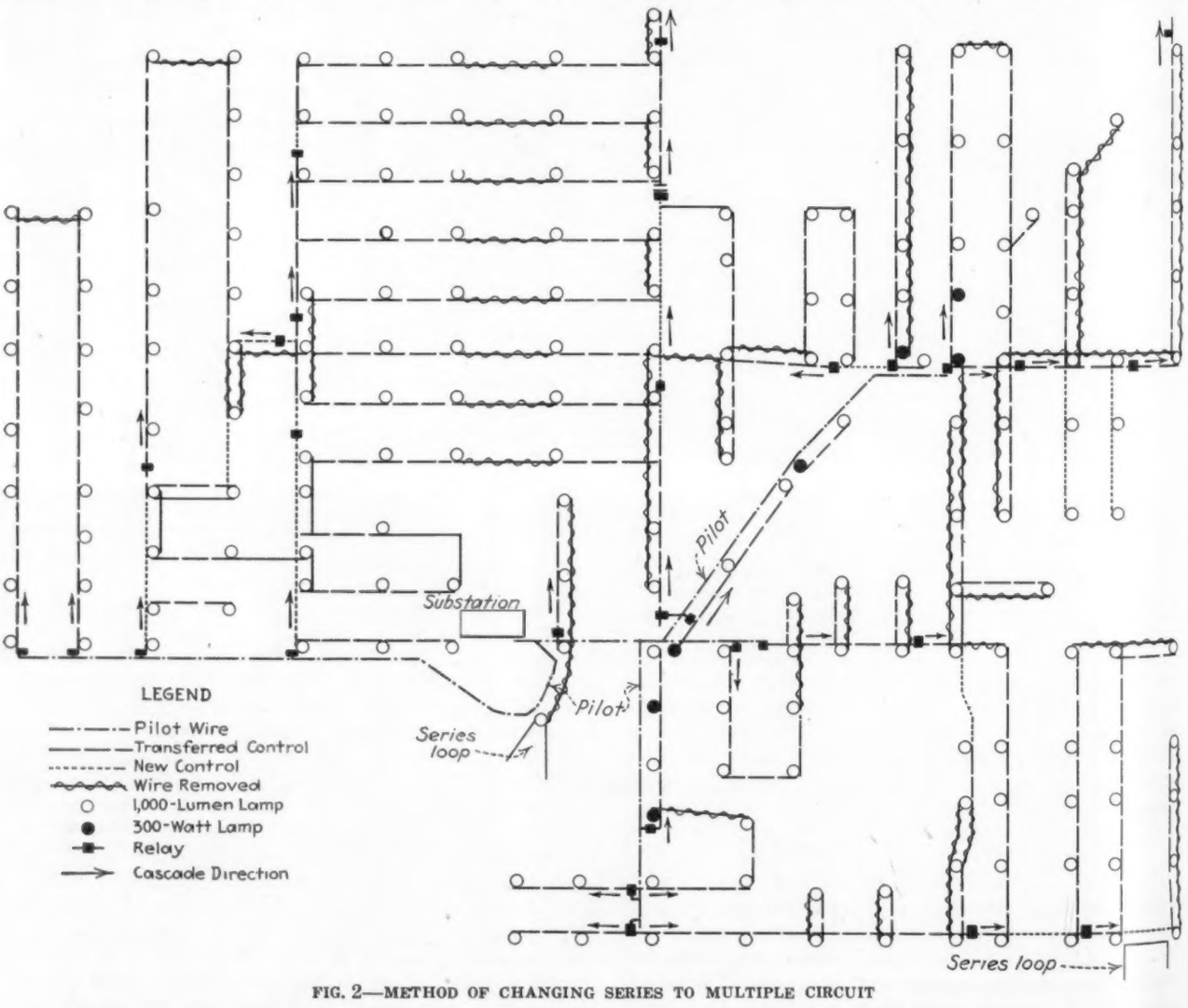


FIG. 2—METHOD OF CHANGING SERIES TO MULTIPLE CIRCUIT

change-over. Any mistakes made by linemen in cutting over circuits are usually indicated by a lighted lamp and corrected immediately. Very little new wire is necessary, because, when its condition will permit, the second wire of the series loop may be used where a control wire must be strung in a new location.

Each 120/10-volt transformer used in connection with the 1,000-lumen series lamps is fused with a 3-amp. plug to protect the system. The 300-watt multiple lamps are fused at 6 amp.

Wall maps similar to those now used for the series system will be made for the multiple circuits, and all lamps and relays will be shown in their respective places. Trouble maps, consisting of small sections of the lighting circuits, show the location and size of all lamps and relays and are available for troublemen working on these circuits.

The question of the type of lamp to use probably arises with every new multiple circuit. The first cost of using multiple lamps is much less, due to the fact that transformers are not necessary. However, the multiple lamp needs renewing approximately two or three times as often as does the series.

The series lamps should not be used on multiple circuits if a high efficiency of illumination is to be maintained, because of discoloration of the glass due to evaporation of the filament. On a constant-current circuit this is overcome by an increase in brightness caused by the increased current. The multiple lamp is not subject to discoloration to the same extent as the series lamp when placed on a multiple circuit and will usually burn out shortly after its rated life. On the other hand, the series lamp becomes dim and will burn many hours over its rated life at the expense of illumination. Multiple lamps, then, insure better lighting, as the series lamps are seldom replaced regardless of the intensity of burning as long as they will light. Both types of lamps are being tried on this circuit, and as soon as sufficient data are available a definite policy regarding lamps will be adopted.

TABLE III—LIGHT QUANTITY AND UNIT COSTS FOR SERIES AND MULTIPLE CIRCUITS

System	No. of Lamps	Rating	Unit Lumen	Total Lumens	Operating Cost	Cost per Lumen
Series circuit....	9,725	100 cp.	1,000	9,725,000	$154,870	$0.00940
	1,688	400 cp.	4,000	6,752,000		
Total.....	11,413			16,477,000	$154,870	$0.00940
Multiple circuit	9,725	100 cp.	1,000	9,725,000		
with series lamp	1,688	400 cp.	4,000	6,752,000		
Total.....	11,413			16,477,000	$145,815	$0 00885
Multiple circuit	9,725	75 watts	920	8,947,000		
with multiple lamp	1,688	300 watts	5,000	8,440,000		
Total.....	11,413			17,387,000	$154,197	$0.00885

Table I shows the cost of converting the initial section of series circuit to multiple, using series lamps and transformers, as was actually done in this section, compared with multiple lamps had they been used. This shows that the cost of changing the system can be reduced from $18.25 per lamp to $9.06 by installing multiple lamps on the new circuits. More efficient illumination is also guaranteed at a slightly higher operating cost than would result with the use of series lamps and transformers.

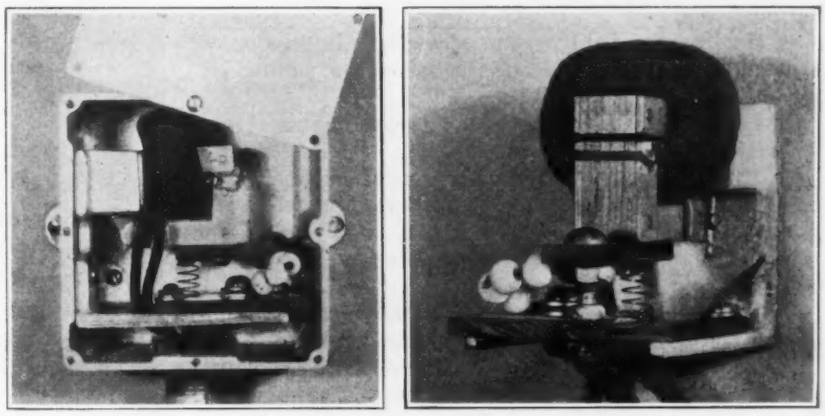


FIG. 3—RELAY SWITCH DEVELOPED FOR CONTROLLING MULTIPLE STREET-LIGHTING CIRCUITS

TABLE II—COMPARATIVE OPERATING COSTS FOR MULTIPLE AND SERIES STREET-LIGHTING SYSTEMS IN SEATTLE

	Multiple Circuit*		
	Series Lamps with Transformers	Multiple Lamps	Series Circuit
Production	$11,550.00	$13,200.00	$12,850.00
Transmission and transformers	2,390.00	2,740.00	2,660.00
Superintendence			
Pole lines	1,571.42	1,571.42	1,571.42
Street circuits	1,388.62	1,388.62	2,777.25
Unclassified	5,800.00	4,350.00	5,800.00
Operation			
Pole lines	6,245.33	6,245.33	6,245.33
Street circuit feeders	6,302.00	6,302.00	12,604.05
15,000-volt lines	2,200.00	2,200.00	2,200.00
15,000-volt submarine cable	88.00	88.00	88.00
Pole line reconstruction	228.50	228.50	228.50
Street circuit reconstruction	9.96	9.96	9.96
Overhead transformers	710.16	710.16	710.16
Miscellaneous	222.00	222.00	222.00
Substations	1,200.00	1,200.00	2,400.00
Miscellaneous expense	1,140.00	1,140.00	1,140.00
Maintenance			
Pole lines	2,395.27	2,395.27	2,395.27
Street circuit feeders	526.19	526.19	1,052.38
Towers	39.80	39.80	39.80
15,000-volt lines	110.00	110.00	110.00
Substation	238.50	238.50	477.00
Telephone system	119.00	119.00	119.00
Operating expense street lamps	4,750.00	5,280.00	5,280.00
Lamp renewals	15,100.00	24,000.00	15,100.00
Lamp repairs and accessories	13,300.00	11,700.00	10,600.00
General expense	2,590.00	2,590.00	2,590.00
Depreciation and amortization	29,500.00	29,500.00	29,500.00
Interest and bond redemption	36,100.00	36,100.00	36,100.00
Total	$145,814.77	$154,197.77	$154,870.62

* Estimated

To change the entire Seattle street-lighting system of 11,413 series lamps to the multiple system would require an expenditure of roughly $250,000 with series lamps and $150,000 with straight multiple lamps, allowing for the installation of secondary wire where none now exists. It is believed that this amount is considerably less than would be the cost of installing any other type of multiple circuit.

FREQUENCY OF LAMP REPLACEMENT IS AN IMPORTANT CONSIDERATION

The figures in Table II show the estimated cost of operating a multiple system such as that being installed in Seattle. The series circuit costs are the actual figures for the year 1925, whereas the estimated costs for the multiple circuits were obtained by using percentages based upon equipment and power consumption. The book costs show that all lamps are renewed approximately twice a year. It is estimated that the multiple lamps will require replacement between three and four times in a year. The figures in Table II are liberal, and it is possible that operating costs for the multiple cir-

cuits will fall even lower than those given. However, the multiple system shows a slight decrease in operating charges over the series arrangement of lighting equipment.

Table III illustrates the advantages of using the multiple lamp and the multiple circuit from the standpoint both of illumination and of cost per unit of light flux.

Comparative Advantages

The many advantages of the multiple street-lighting system, as it is being installed in Seattle, may be summarized as follows:

1. Necessary investment in street-lighting equipment is reduced.
2. Danger of the high-voltage series circuit is eliminated.
3. The power factor of the system is increased from between 65 and 80 per cent to between 90 per cent and unity by the elimination of constant current transformers.
4. Continuity of the system as a whole is greater on the multiple circuit, because failures are limited to small sections.
5. Lights are assured even if an open circuit occurs in one of the control wires or relays.
6. The multiple circuit may be energized during the day for inspection without endangering linemen, and repairs may be made at that time.
7. Lamp replacement may be carried on during the day or at night.
8. The saving in station, underground duct space and, in many places, cross-arm space is considerable.
9. The difference in operating costs is 0.55 mill per lumen (nearly $10,000 for this system) annually in favor of the multiple circuit.
10. The Seattle circuit is most flexible and may be used for many other systems besides that of street lighting.

Reducing Control Panel Space

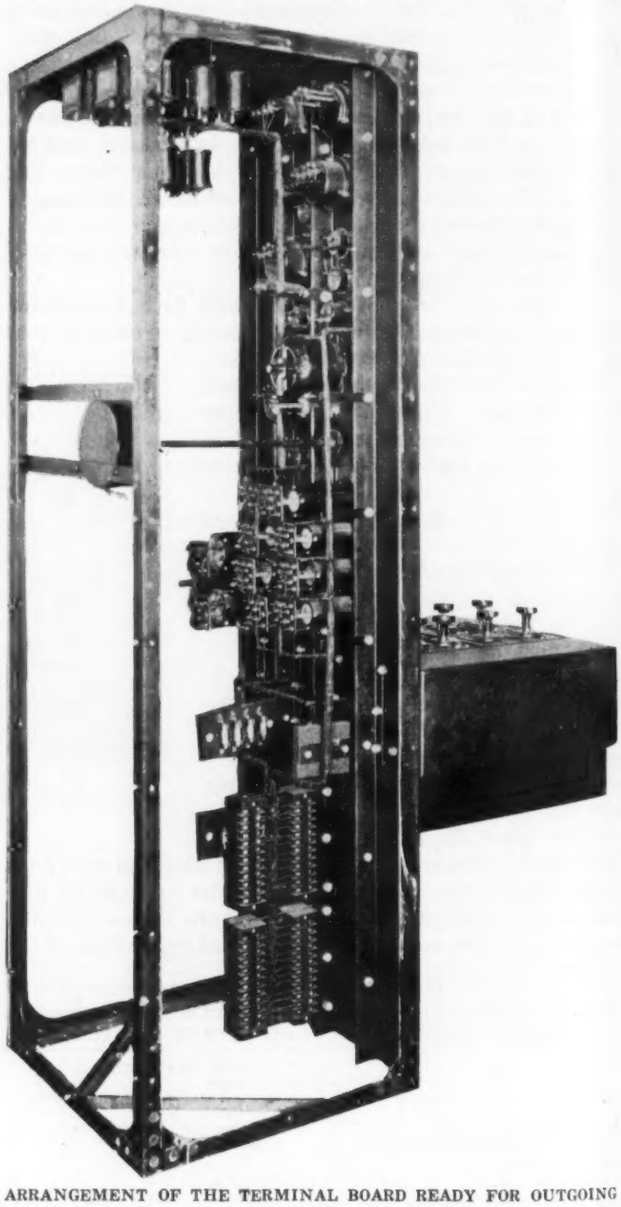
Construction of a So-Called "Miniature Control Desk" Utilizes Essentially Standard Equipment —Compact Arrangement of Instruments and Controls a Feature

By Charles McL. Moss
Westinghouse Electric & Manufacturing Company

IF WE consider the majority of control panels for generators, we find that the average panel controlling a large generator is at least 24 in. wide. The feeder circuits are more compact and it is probable that an average width of 6 or 8 in. per feeder is a fair estimate. If, however, we consider a plant with twelve or fifteen generators and 40 or 50 feeders, we find that the actual operating board is from 50 to 60 ft. long, probably more when we take into consideration the various regulator, exciter and field control panel units necessary.

The Westinghouse Electric & Manufacturing Company has recently developed a so-called "miniature control desk" utilizing essentially standard equipment but mounting it in a compact form. The illustration shows a front view of four sections of such a desk, with the two end sections left blank. The section to the left is for the control of a large turbo-generator and includes all instrument and control equipment necessary for the generator, including its direct-connected exciter, field circuits and regulator.

In addition to the equipment listed with the accompanying illustration of the board it is also provided with controllers for the field switches so that the generator fields can be connected either to the direct-



ARRANGEMENT OF THE TERMINAL BOARD READY FOR OUTGOING CABLE, ALSO THE SMALL TERMINAL BOARDS ON THE CONTROL SWITCHES WHICH HAVE BEEN PROVIDED FOR EASY ACCESS AND MAINTENANCE

connected exciter or to a spare exciter bus, all of this in the width of 6 in. All control switches are of the standard type, small, telephone style indicating lamps being used. Controllers are provided with slip contacts, and on the main breakers red, green and white indicating lamps are provided. The white lamp lights only when the breaker trips automatically. A complete set of synchronizing switches is provided, the synchronizing contacts being built into the main breaker control switches, these being provided with key interlocks so that it is impossible to attempt to synchronize more than one machine at a time.

The section to the right is a feeder section and will control three feeders, each feeder being equipped with polyphase wattmeter, ammeters, control switches with

red, green and white indicating lamps and synchronizing key interlocks. The control desk is completely equipped with miniature busbars and cardholders for the main connections. The material of the desk is ⅛-in. stretcher lever or so-called "furniture" steel. Each vertical section is in effect a pressed channel of ⅛-in. steel.

The horizontal or desk section is a formed box of ⅛-in. steel with a removable bottom and with open back registering with an opening in the vertical panel. The construction, including the iron bracing, is shown in the second illustration. It is intended that the station voltmeters and synchroscopes, as well as the signaling instruments from the engine room, will be mounted on brackets, preferably at top or end of panel.

The construction of these sections is such that any number may be combined to make a complete board. The indicating wattmeters, reactive factor meters and power factor meters are approximately 4 in. in diameter and have movements identical with the larger and more frequently used switchboard instruments of the usual 5½-in and 7½-in. diameter.

The question may be raised as to the possible objection of using such small instruments. Obviously, however, it is easier to read a 2-in. instrument 3 ft. away than a 7-in. instrument 20 ft. away, which is about the average ratio, as each generator only takes 6 in. instead of more than 24 in. and each feeder takes only 2 in. instead of 8 in. or more.

Of course all relays, recording instruments, regulators and similar equipment are and should be mounted apart from the control desk. Such equipment is not operating equipment and may readily and properly be taken care of by an assistant operator.

FOUR SECTIONS OF THE CONTROL DESK, WITH TWO END SECTIONS LEFT BLANK

Generator circuit is provided with a polyphase indicating wattmeter, a reactive kilovolt-ampere meter, three alternating-current ammeters, one alternating-current voltmeter, one direct-current ammeter and one direct-current voltmeter, engine room signal device, voltage-adjusting rheostat for use with automatic voltage regulator, voltmeter switch for alternating-current voltmeter, voltmeter switch for direct-current voltmeter, governor control switch, generator rheostat control switch, exciter rheostat control switch, regulator cutout switch, emergency throttle trip switch and regulator transfer switch for transferring from hand to regulator control. Equipment also includes circuit breaker controllers, controlling circuit breakers for main bus, spare bus and generator neutral breaker respectively.

Two All-Electric Kitchens in Cleveland Hotel

Allerton Hotel in Cleveland Makes Initial 142.9-Kw. Installation—Advantages in Operation of Electrical Equipment the Deciding Factor

ELECTRIC cooking equipment having a total connected load of 142.9 kw. has been installed in the main kitchen and coffee shop of the new Allerton Hotel, Cleveland. The decision on the part of the hotel management to go to almost complete electrification of its kitchens was made only after a careful investigation and comparison of all types of cooking equipment had indicated the advantages of the electric heat over fuel firing.

Negotiations with the hotel manager and building architect were first begun by the sales department of the Cleveland Electric Illuminating Company at the time construction was started, when a report on the use of electric cooking and baking equipment was submitted. This report included specifications of the electrical cooking equipment that would be required, an estimate of the probable energy cost per month under the rate the hotel would earn and an outline of the reasons why electric cooking would be advantageous. These specific advantages, which proved of considerable weight in influencing the final decision in favor of electrical equipment, are outlined here.

ELECTRIC COOKING EQUIPMENT INSTALLED IN ALLERTON HOTEL, CLEVELAND

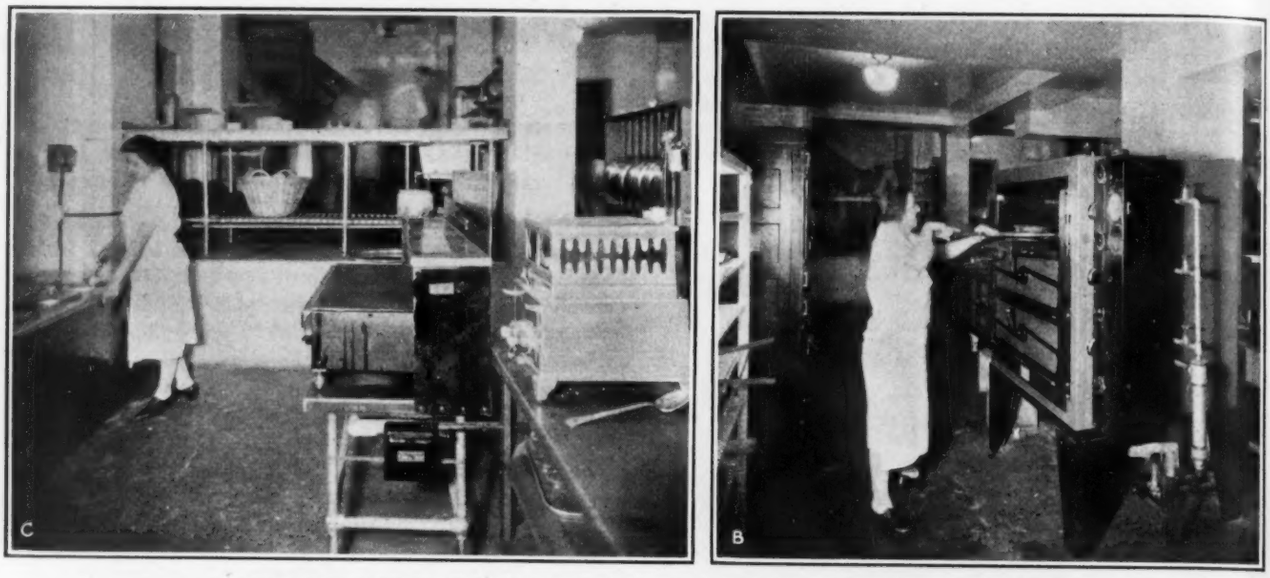
	Kilowatts
Main Kitchen:	
Three 22-kw. ranges	66.0
One 10-kw. broiler	10.0
One 60-loaf oven	9.0
One 36-in. griddle	6.0
One two-section waffle-iron	1.3
One eight-slice toaster	5.5
Coffee Shop:	
One 22-kw. range	22.0
One 80-loaf oven	10.8
Two waffle-irons	2.8
One eight-slice toaster	5.5
One 18-in. griddle	3.0
One box heater	1.0
Total connected load	142.9

Representatives of the manufacturers of electric cooking equipment were then called in and arrangements were made for the hotel management to make several inspection trips to hotels, clubs and hospitals in Cleveland that were using electrical equipment. This appeared to be the turning point, as it was found that a number of electric kitchens were operating to the complete satisfaction of the chefs and at a satisfactory cost for energy.

"When the first plants were drafted," said Mr. Martin, manager of the Allerton Hotel, "we realized fully that electricity is in every respect the best form of energy for the cooking of food. The reported cost, however, seemed high.

"When we made the final check for the Allerton, we found the power rates altogether favorable, and so, despite the fact that electric cooking equipment costs considerably more than that for the use of fuel, we decided upon it. Electric cooking saves space, reduces fire hazards, cuts down burns and such accidents, improves cleanliness, enhances the quality of the food, pleases the guests and is a constant source of satisfaction to the management, the chefs and their assistants."

The electrical equipment so far installed in the main



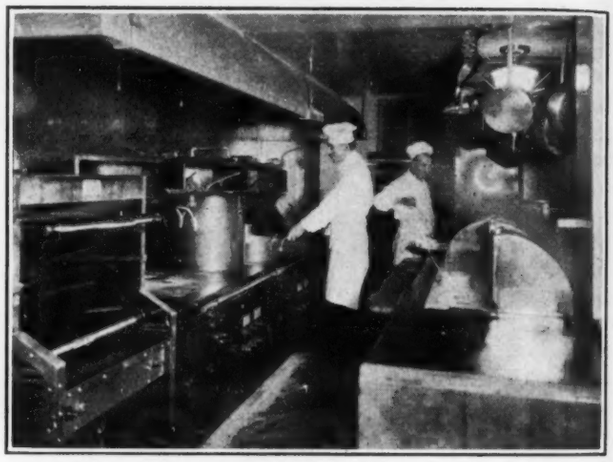
ELECTRIC HOT PLATES, GRIDDLE AND OVENS CONSTITUTE PART OF KITCHEN EQUIPMENT

kitchen and coffee shop are shown in the accompanying tabulation. No attempt was made to compare the cost of electric operation with other fuels, as there is a good supply of natural gas available, at a low rate. Also the initial cost of the electrical equipment was at least twice that of any other.

Energy for cooking will cost approximately one and a half cents or less per kilowatt hour, depending upon the amount used per month, it is estimated. As the number of meals served daily increases it is expected that the unit cost of operation will decrease. On the basis of 1,000 meals served daily it is expected that less than 0.6 kw.-hr. will be required per meal.

The chefs in the Allerton kitchens, who had had no previous experience with electrical equipment, are well pleased with its operation and required very little help or instruction by the representatives of the manufacturers other than explanation of the operation of the switches and heat control. The kitchen layout was designed and installed by the John Van Range Company of Cleveland with the assistance of the Edison Electric Appliance Company.

A careful check on the demand and energy consumption of the different cooking units is being kept and it is expected when the hotel gets under full operation to obtain some valuable data covering the kilowatt-hours and costs per meal served under electric operation.



BROILER AND THREE RANGES ALL ELECTRICALLY HEATED

Advantages of Electric Cooking for Hotels

Quality of Food Prepared. — Food prepared by electric equipment is better in quality and more uniform in texture, and spoilage and shrinkage are less. The last two items save material and labor, thus reducing the actual fuel and operating cost.

Satisfaction of Help. — Kitchen help is better satisfied with electric cooking equipment, and labor turn-over is reduced. The help like the simplicity of control, the reduced heat radiation, the cleanliness and the pure air conditions that go with electrically heated cooking equipment.

Floor Space Required.—Due to the even heat distribution on the top of the ranges and in the ovens, it is usually possible to do a given amount of work with less equipment where electricity is used, thus reducing the floor space required.

Ventilation. — Ventilation problems are simpler, as there is no combustion taking place in the electric range and oven.

Air Conditions.—The air in an electric kitchen is pure and unadulterated by gaseous products of combustion. Despite good ventilation, oxygen is lacking in any kitchen where combustion takes place in ranges and ovens, or under griddles, hot plates and urns.

Cleanliness.—The kitchen using electric cooking equipment is free from soot and other products of combustion, which will cling to the walls and ceiling.

Safety.—Fire hazards are minimized and danger of explosion is removed when electric appliances are used.

Dependability of Fuel Supply and Pressures.—Electricity furnishes a dependable and constant fuel supply winter and summer with no shortages and low pressures.

Advertising Value. — Patrons and guests are glad to know that they are being served from a clean, sanitary and modern kitchen.

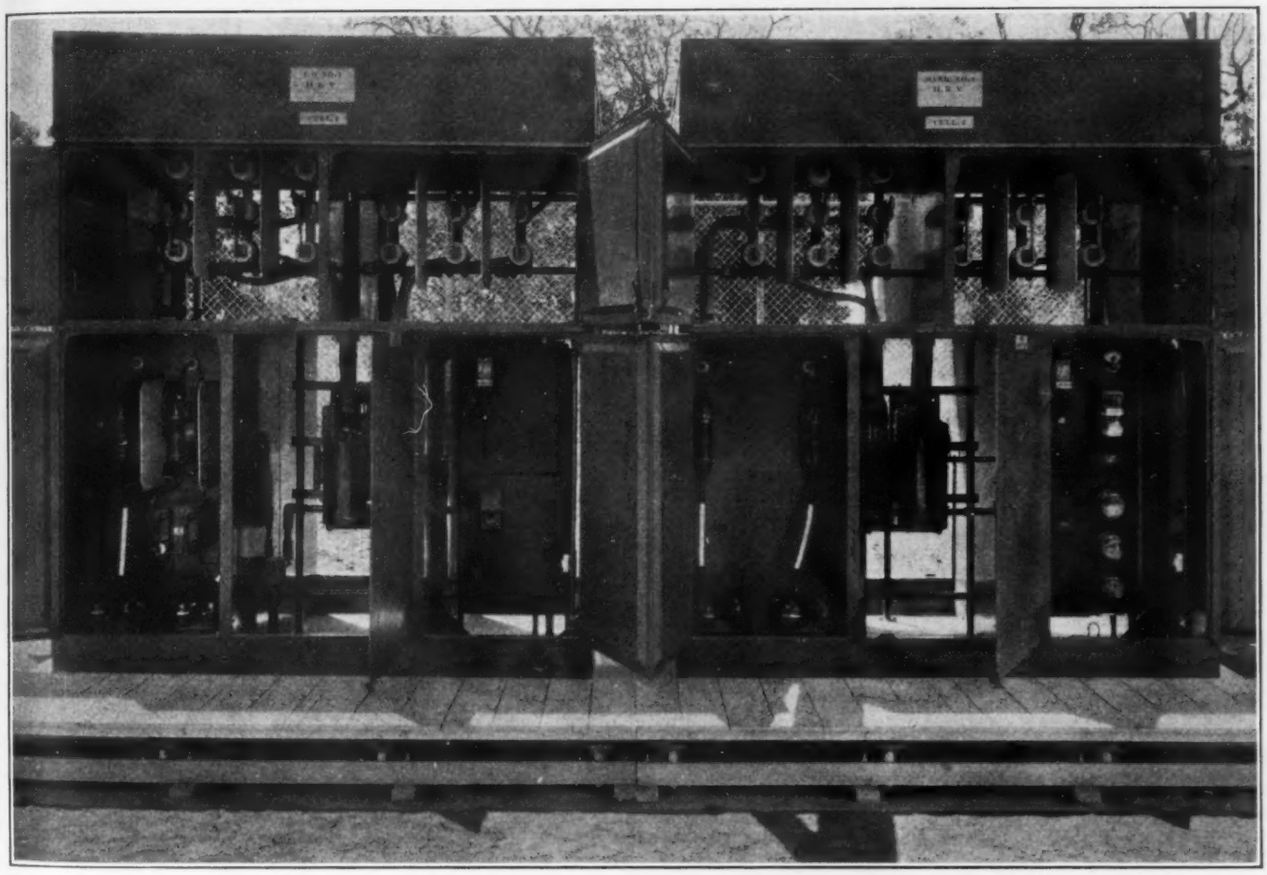
Depreciation and Repair.—Depreciation is very low on electric ranges and ovens. Top plates on the ranges are very heavy and re-enforced to stand real heavy-duty service. They never warp, sag or crack. Electric ovens installed fifteen to twenty years ago are in use today with the original heating elements intact.

Trend of Fuel Rates.—Over a period of 30 years the cost of electricity has been steadily reduced, whereas the cost of other fuels has increased in most cases. This would indicate that in the future the advantages of using electricity will be still more marked.

Steel-Cell Unit-Type Outdoor Substation

Lower Cost, Higher Salvage Value, Better Appearance and Possibility of Using Equipment Obtained from Rebuilding of Large Indoor Stations Constitute Important Advantages of This Type of Outdoor Construction

By RICHARD C. POWELL
Pacific Gas & Electric Company, San Francisco, Cal.



INTERIOR OF TWO 11-KV. STEEL CELLS SHOWING ARRANGEMENT OF EQUIPMENT
Note the double-throw switches in the upper left-hand corner and the single-pole switches in the right-hand corner of the cabinet for bypassing the oil switch without interrupting service.

A NEW TYPE of outdoor substation, views of which are shown in the accompanying illustrations, which has a number of advantages over the conventional type has been developed by the Pacific Gas & Electric Company. The first of these stations to be built is for 11 kv. to 4.1-kv. distribution, although other voltage combinations may be used.

All equipment such as oil circuit breakers, disconnecting switches, metering and control equipment, etc., for each feeder, whether incoming 11 kv. or outgoing 4.1 kv., is housed as a unit in a steel cell, approximately 6 ft. wide, 9 ft. long and 10 ft. 6 in. high. The bus is extended from one cell to the next through brass pipes connecting the steel cells. All equipment in the cells is standard indoor equipment.

Connections between units, except bus connections between adjacent cells, are made with lead-covered, paper-insulated cable drawn into underground ducts. Transformers are purchased with terminal boxes for cable connections. Connections to the overhead circuits are made with pole risers and ducts to the feeder cells. This results in a station with very neat appearance and with no exposed live parts, so that the only additional protection necessary is a fence around the station as a whole.

This form of construction has been adapted to the following general types of distribution:

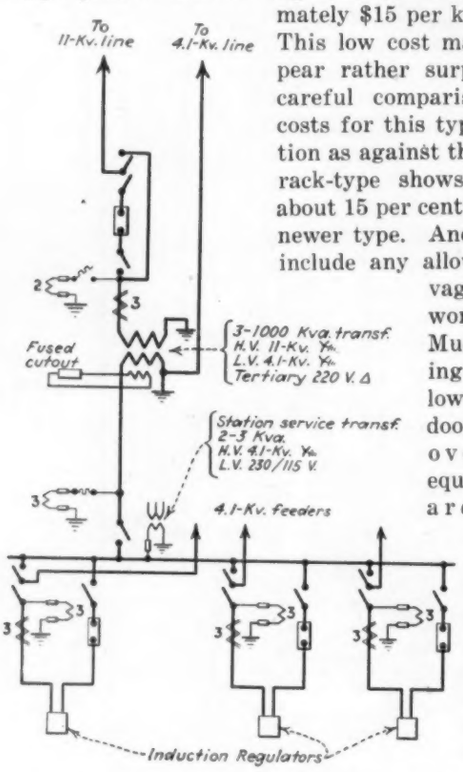
1. For low-tension feeders when stepping from some higher voltage, say 60 kv., to either 11 kv. or 4.1 kv.
2. For both the high and low sides when stepping from 11 kv. to 4.1 kv.

The 11-kv./4.1-kv. substation represented by the single-line diagram consists of a bank of transformers connected on the high-voltage side through an 11-kv. oil circuit breaker to an 11-kv. supply circuit and on the low-voltage side to a 4.1-kv. bus with three 4.1-kv.,

three-phase feeders, each regulated by three single-phase regulators. Disconnecting switches permit the inspection and repair of oil circuit breakers and equipment and insure better continuity of service in the event of failure of either oil breakers or regulators. The 4.1-kv. feeders are controlled through automatic reclosing breakers.

The advantages of this type of substation construction may be summed up as follows:

1. Lower cost. For a 3,000-kva. substation with three 4.1-kv., three-phase feeders, each regulated by three single-phase induction regulators, the cost is approximately $15 per kilovolt-ampere. This low cost may at first appear rather surprising, but a careful comparison of actual costs for this type of construction as against the conventional rack-type shows a saving of about 15 per cent in favor of the newer type. And this does not include any allowance for salvage from other work (see item 3). Much of this saving is due to the lower cost of indoor breakers, etc., over outdoor equipment. There are possibilities for further saving by building the units completely wired in the shop and hauling them by truck to the site. In this case the only field work would be the foundations, fence and cable connections. It is believed some additional saving will be gained as more experience is had with this type of construction.



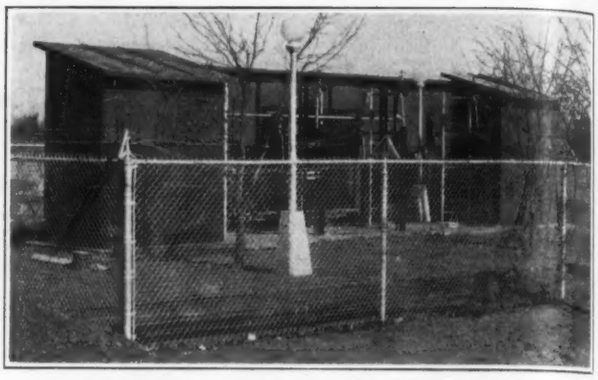
SINGLE-LINE DIAGRAM OF AN 11-KV / 4.1-KV. SUBSTATION

2. Steel-cell stations have a higher salvage value and are better adapted to changes in capacity and in some cases to change in location of the substation. The units can be very readily moved from one point to another with minimum expense. This is a very desirable feature on a large and rapidly growing system.

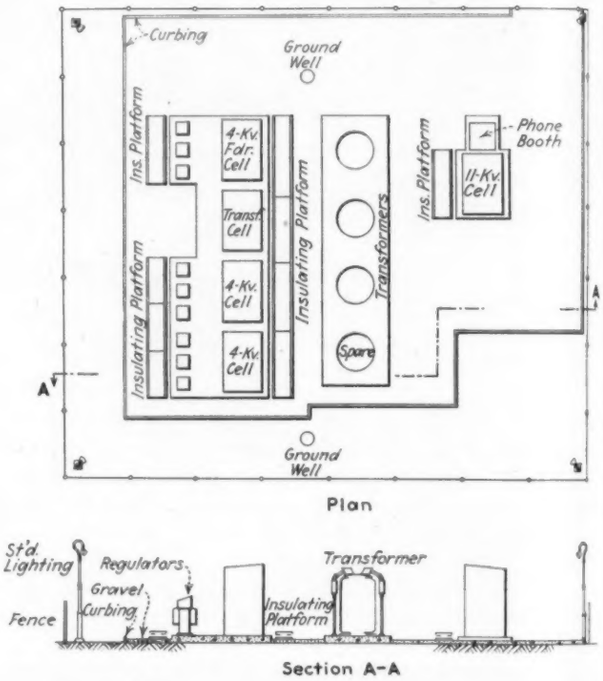
3. Ability to use indoor equipment salvaged from the reconstruction of large indoor stations is an important advantage. Such reconstruction is continually being done on a large system because of increasing loads and inadequate rupturing capacity of oil circuit breakers. Many of these circuit breakers, however, and much of the equipment so replaced are adequate for the loads and rupturing duty at many other points on the system.

4. Better appearance. It is necessary only to repaint the steel cell station to maintain new appearance.

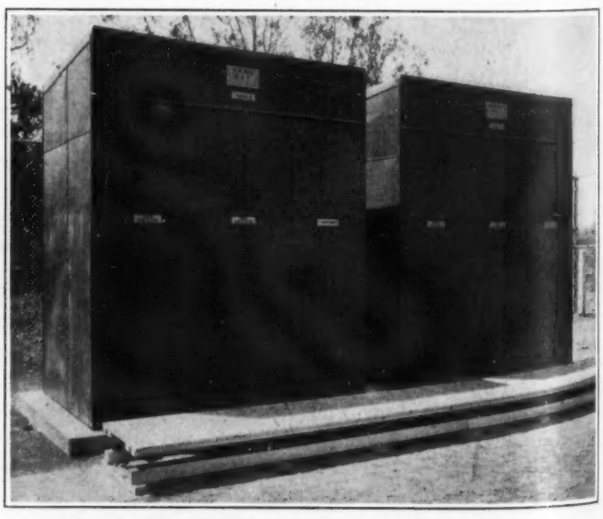
5. The steel-cell construction is safer, from the standpoint of safety both to persons and to service. There are no exposed live parts with which children or other unauthorized persons can come in contact, and there is no possibility of trouble from birds or animals.



GENERAL VIEW OF 11-KV./4.1-KV. STEEL-CELL SUBSTATION



GROUND PLAN OF STEEL-CELL DISTRIBUTION SUBSTATION



OUTSIDE VIEW OF 11-KV. STEEL CELLS

Interconnections

Engineering and Service Possibilities Outlined—Principles to Apply to Realize Advantages—Definitions and Illustrations—Rigid Connections Unnecessary

By ALEX DOW*
President Detroit Edison Company

INTERCONNECTION, from my point of view—an engineer who is a manager by force of circumstances rather than by choice—is very largely a matter of financial considerations and policy rather than of technique, and yet there are so many of the technical phases of it that must be considered from the financial standpoint that I shall have to touch on them. Transmission of electrical energy at voltage suitable to distance, amount of energy to be transmitted, and so on, is an art that you might say has acquired, obtained and developed a technique. Interconnection has not yet developed that technique.

Interconnection is different from transmission. Transmission of energy to an area in which that energy is to be distributed and used from a distant water power is probably the most clear-cut case of transmission. It was in that way that transmission, as we call it now, began. Reduced to the simplest element, you have a power plant at the distant water power. You have a transmission line of which the physical characteristics include the selection of voltage adapted to the predetermined condition of the amount of energy to be transmitted, the distance and the permissible—commercially permissible—loss in transit. Practically no line of that character reaches the place where the question of loss in transit is interlocked with the question of stability of operation. That is to say, the commercial condition that limits the loss makes the line stable. The unstable line is the line that develops itself in a long expansion or interconnection of existing systems under conditions where the energy has to be passed to a distance not originally contemplated.

TRANSMISSION IS DISTINCTLY DIFFERENT FROM INTERCONNECTION

Transmission in series—transmission by stages—is not interconnection, although it approximates very closely to it. The shifting, however, of energy from the point that has surplus generating capacity for the time being to the point that is without adequate generating capacity is not a straight transmission from generating point to receiving point. It is a changing in the proportionment of the load between the interconnected transmission systems. The one that has excess capacity proceeds to deliver more power to its neighbor and that neighbor passes over the equivalent amount of power to the next neighbor and so on until the actual delivery is in the receiving point. You still have a problem in transmission unless you have developed that state of affairs into what is the next step—interconnection of systems.

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Interconnection is the interchange of electrical energy between self-sufficient and self-contained electric systems. It is not delivery of energy generated by one property to a receiving property. It is the actual making of such arrangement, physical and commercial, as will allow two or more complete systems, each of them self-sufficient, each of them having its own generating system, its own plant and its own customers, to interchange energy when and as it may be convenient for them to do so. Such a case might occur and is quite likely to occur if the Toledo zone system at Toledo, which has its own complete plant and which, by the way, is interconnected southward into the American Gas & Electric system further down in Ohio, should be connected with the Detroit Edison Company, the Detroit Edison Company should be connected with the Consumers Power Company and the Consumers Power Company should be connected southward into Ohio spanning the very short remaining distance to pick up the American Gas & Electric Company lines which again swing around to Toledo.

COMMERCIAL CONDITIONS WILL DETERMINE WHERE INTERCONNECTIONS WILL BE MADE

The foregoing is merely illustrative and does not imply that this is something these companies are doing. It is one of the very evident possibilities to be brought about when circumstances make it worth while, and the circumstances are likely to be commercial rather than technical. In that case it is quite evident that there might be interchanges between any of the four large systems. Interchange might be in any direction around the circle that I have indicated or by short cuts from, say, Jackson to Toledo. It might be across the interior of the circle. One season it might be in one direction, as, for instance, during times of flood on the Michigan rivers, when there is an excess of power in those rivers—more than can be used locally. That energy might be sent to the neighbor who could use it. There might be other times when such troubles as railroad car shortage or shortage of coal might make it possible to send energy up from south of Toledo. Such occasions have frequently arisen.

There have been times in the past when the Toledo gateway for our coal has been so badly congested that almost any kind of transmission line would have been welcome. We needed the coal to generate energy, not by the cheapest transmission, which is by coal in 50-ton railroad cars, but in the only form of transmission that, in those circumstances, would have been any help to us—namely, electrical energy over wires. There may be any number of conceivable cases. There might be cases

of overloading and underloading and there might be cases of shortage of capacity and power house trouble, and so on.

Mutual Assistance Paramount

BROUGHT up in the school in which I was—the school that considered an interruption of service as almost in the nature of a crime—you will realize that anything that has the characteristic of reserve capacity has a great attraction and is highly valued by me. Of all the possibilities of interconnection (as distinguished from transmission and the interconnection between neighboring systems, each self-contained and self-sufficient) that of mutual assistance when assistance is necessary is commercially the most important. It has the greatest value to our public and thereby it has the greatest value to us. That alone will, in my opinion, justify the making of more interconnections than any other one cause.

If such an interconnection as I have outlined in this area should be completed, I can say definitely, because of my knowledge of the minds of the parties interested or to be interested therein, that the possibility of mutual assistance would be to them the predominating reason for incurring the expense of the interlinking lines. The ability to call on the resources of three other companies in addition to one's own is a most attractive possibility to the man who is ultimately responsible for continuity of service. The knowledge that there will be no time in which one or another of them cannot help him with from 10,000 to 40,000 kw. or possibly 50,000 kw. over the available interconnections will be of very great help. The checking up from time to time of available capacity and the making of arrangements whereby it can be had quickly will be a matter that will be gone at intelligently. It will not be a matter of wrangling and arguing and bickering who is to pay and who isn't and what his price is to be. It will be a matter of considering the possibilities as they stand for the common good of all the parties, and therein it will certainly, in my opinion, take first place among the reasons for interconnections.

Bypass Valves Afford Extra Capacity

Now consider our own practice. We have come to the decision that the only reserve capacity that is really first class is capacity that is available instantaneously. That is obtained only by the machine capacity margin above the load on the machines then and there on the line. We have, in fact, followed that idea up to the point where we habitually buy our turbo-generators with a very decided excess of carrying capacity in the windings of the generators, so that occasional overloads will be handled without impairing the field regulation and stability and so that an overload can be had at any time without overheating.

To meet that condition in the generators we have developed a method that I do not believe has become common, that of depending on the bypass valves of our steam turbines to give us excess capacity when required. That is to say, there may be running three or four turbo-generators at one time in one area—in one of our sub-areas—and these will be running at or about the point of most economical operation, which will be, of course, the point at which the steam that can be passed through the first-stage nozzles is being expanded to the limit, to the lowest possible pressure, which is therefore the point at which the first-stage nozzles are full and the condenser is working below its possible capacity. The vacuum is the best possible and the full boiler pressure is being developed to the first stage.

Now, the next step in any commercial turbines of today is to open a bypass, which allows steam to enter the turbine further down several stages—further down the series from the first—and immediately reduces the efficiency of the turbine, but may increase its output by, say, 15 or 20 per cent if the bypass be fully opened. That means, of course, that more steam has to be made. It means that the boilers must be immediately called upon for more steam, but the nature of these large steam generators of today, whether they be stoker fired or pulverized coal fired, is that they can be pushed, with not much diminution of efficiency, considerably beyond a point at which one would desire to run them habitually. In other words, with reduced efficiency—that is to say, with a greater use of steam per unit—it is possible to increase the output of a power plant from 15 to 20 per cent by this device of opening bypasses.

If you have a power plant or a series of power plants running, say, five units or six units at one time, these being by assumption identical units, it is evident that you may lose any one of these units and yet pick up the load very promptly by opening the bypasses on the others. Because of the reduced efficiency of the same output, you will need more steam and you will have to push your boilers, but you will very immediately have reserve capacity—almost instantaneously available—with nothing more at its worst than a very slight drop in frequency or voltage during the time in which the bypasses are being opened.

It is, of course, possible and frequently done to put the bypasses on the governor, but that is a condition which, with very large units, is not so stable as the other. It means that any little irregularity in governing swings your turbines past the point of best efficiency and back again. The preferred practice of the Detroit Edison Company is to run with the condition I have spoken about—namely, very close to the point where the turbine is doing all it can do without bypasses being opened, a point which in the ordinary design in the turbine corresponds to the maximum steam efficiency, and at that point having 15 or 20 per cent, according to the design of your turbine, reserve capacity obtainable by the opening of the bypass valves. In practice the bypass valve can be opened by hand in a large system, but in a small system with only three or four machines it may be necessary to provide quick opening means or adopt the alternative of putting it under the control of the governor.

Value of Reserve Augmented

Assume you have another system in exactly the same condition. Assume the two are interconnected and running in multiple. I am not suggesting that is the condition that you would, in practice, arrive at, because it is a condition that involves several assumptions that cannot always be made, but assume that that is the case. It is quite evident that the loss of one generator unit has only one-half the possibility of injuriously affecting the service that it had in the other case. In other words, for the loss of any one unit you have twice the reserve capacity immediately available. Now, that may be interpreted and must be, of course, interpreted according to the law of probabilities—the probability of

losing a generator in each system or two in one system, and so on. A study of times and seasons, and things of that character, indicates that the chances of coincidence are remote. It does happen. I recall an occasion when the Detroit Edison Company lost three turbines within 48 hours, but that was one of the incidents of the after-war period and was attributable to very natural causes, and losing any one of the three was not a surprise. The only surprise was that they all waited long enough to go off together instead of falling off at intervals. That coincidence is the exception and it takes the exception to prove the rule; so it becomes evident at once that if you interconnect two systems, each equally self-contained and each following the same method, you have reduced by one-half the probability of even minor interference with service by the loss of a generating unit. Expressed otherwise, you have added 100 per cent to your reserve capacity.

Of course, one may then make elaborate calculations as to what the reserve capacity is worth. In the emergency one can tap a reserve capacity that is 50 or 60 or 100 miles away, but it is not reserve capacity under your own hand if even the two systems are in contact at half the distance; neither is it absolutely the same as an increase of capacity in the shape of another set in your own premises, but it is much cheaper and it is likely, according to the application of the law of probabilities, to be just as useful if the interconnection can be made to the extent of the capacity of one generating set. Such an interconnection may be made for a figure very much less than the cost of installing the extra generating set in your own premises. Then the commercial desirability is evident.

Rigidity of Interconnection

INTERCONNECTIONS may be very close or very loose. There may be a trunk line from power house to power house, but usually in cases where there is a certainty that a considerable amount of energy will always have to be transmitted. Or interconnection may take the form of several fringe connections, which, taken altogether, can be used to transfer a considerable amount of outlying demand to the supply of the other concerns.

It does not follow, in fact, that the two properties must operate continually interconnected. To operate interconnected is not always the simplest thing possible. We know a good deal about it here, because we have been operating interconnected with our own stations of greater or less magnitude almost continually since 1899, and that is quite a few years. We have had, that is to say, more than one source of alternating-current supply and they have been interconnected with one another so that they could exchange load and render assistance. From the period, however, of 1915 onward until now we have had interconnections between our own big power plants exactly after the fashion that I have described—that is to say, they have been interconnections between self-sufficient and self-contained areas.

The method of operation, which had been arrived at by chance rather than by design at first, and later by very precise design, is such that the area which each power house could supply and would supply if it were separated is very well defined for the time being. That area is not a constant area by any means. Connors Creek was not required always to cover up to a certain point in the downtown district and Delray to feed up to that point or division line. The conditions of availability of capacity at these power houses were studied and the area, measured by different substation areas which each power house could take care of at the moment with the capacity available, was predetermined and known.

Loose Linkage Helps the Situation Considerably in Detroit

The interlinkages between those areas were not solid; in fact, they were decidedly loose because experience—especially experience in 1918, 1919 and 1920—has shown us that too solid an interconnection meant that both these power houses, Delray and Connors Creek, would go down if either got into serious trouble, whereas a looser connection meant they would cut loose from one another and the trouble would affect only the area served by the one power house. In that case the effect would be reduced by the fact that only the one generating plant could dump into the fault, and the probability of quick recovery was very much increased because there was an existing service with which the generators of the crippled power house could go into step as soon as they could be run into step. In that way our present method has been developed, which now includes Trenton Channel, with its distance of nineteen to twenty miles as the cables run, and Marysville, with its distance of 60 to 70 miles as the cables run. I may note that the distance between Marysville and Trenton Channel by the transmission line through Romeo and Bloomfield and Superior and around into Trenton Channel is 120 miles, so that we have an illustration with us constantly of the possibility of interconnecting and operating in multiple two power houses that are electrically 120 miles apart. There is no difficulty about doing it after you know how.

Out of that question of knowing how, however, there comes a great many things that are commercial. First of all, of course, is how much energy you want to exchange. That has to be settled. That governs the extent to which you will make your interconnection, how big you will build your line, how much of an interlineage you will establish. Then there come all the questions as to how you are going to accept the responsibilities that may arise through habitually running interconnected. We worked out our own problem along the lines I have indicated, by assigning to each power house for the time being, for that hour, and the next hour, and so on, a certain load by areas and by substations and depending upon the breaking loose of that area with its load along the power house, if circumstances should arise that would cause them to break loose.

When Interests are Different

Doing that sort of thing when you have interests that are not identical, when you are dealing with a neighbor concern whose commercial conditions are those of an independent ownership and independent business, is not altogether as simple as it appears, and many of the most interesting circumstances and problems have arisen from just this cause. It is becoming very clear now to the people who have effected interconnections that there will have to be a predetermination of what is going to be manually done or what is going to be automatically done under any conditions in which the interconnection is to be of service beyond the mere stabilizing

effect that it gives while it is working smoothly. Largely interconnected systems, such a system as the one I have spoken about, extending from Milwaukee through into Pennsylvania and in fact to the Delaware River, with several different interests involved, are beautifully stable when everything is all right.

There are, as you have been told in other meetings of the institute, certain pulsations backward and forward of current. In other words, the connection is elastic, but nevertheless it works very nicely indeed and it certainly does stabilize a great many things that with a less extensive system would be or might be unstable. On the other hand, if there is any instability that is not immediately controlled—anything that upsets the orderly flow of current among these large units and over these great links and distances—then there is a change from a condition of stability to a most outrageous condition of instability instantly, and there is the devil to pay. Now, when that happens to ourselves, when one of our four power houses celebrates by getting into a little bit of trouble or when we have a nasty piece of lightning trouble or substation trouble in one of the areas, we know very well the sheer necessity of limiting the interchange of current, and we know that, even with the best of forethought and the best of precautions and the best available apparatus, things happen that would not happen if the amount of energy that could be suddenly dumped into a fault were less.

Tight Linkage Not Essential

The possibility of affording mutual assistance may or may not be secured by running continually linked up and with synchronism. It is very probable that it will not. It is much more likely that the possibility of being of mutual assistance will be better secured in the great majority of cases by running with an open end. Where loads can either be transferred by switching or be taken up by quickly synchronizing two plants with a well-designed routine for so doing, evidence at the present time is rather against the establishment of tremendous reservoirs of energy, such as some of our good friends who never lived with the darn things have been disposed to propose.

That same tremendous reservoir of energy, if it were a lake with good sluices controlling the outflow, might be useful. If it were a great pile of coal in railroad cars that could be ordered to go wherever wanted, but would not start until ordered, it might be useful. If it were even a reasonably good high-pressure water system that could be depended upon to choke itself if the flow developed beyond a certain rate, it might also be very useful. But when we have something that is almost limitless power, doing its work instantly, concentrating all of its energy at one point or another within a distance of 1,000 miles or more, and thereby doing the greatest amount of mischief in an instant of time, the case is different. Something of that kind does not produce the stabilizing influence, the security of service, and the mutual assistance that we want.

Effect of Tight Linkage

Very soon I believe that we are all going to be more or less interlinked and then there will be a very quick picking up of loads, and a very quick transferring of service also. With proper control of the interchange of energy I believe there will be actual running in synchronism of adjacent systems, but the extent to which energy can be exchanged will be very extremely limited and some of the best switchgear that has yet been produced or is going to be produced will be required for those interconnections, so that there may be the correct limitation upon the amount of energy that can pass automatically and uncontrolled from the one system to the other. In other words, mutual assistance, increase of reliability of service, does not at all imply tight interconnections. It may, in fact, under some conditions, imply the exact contrary. It may imply the loosest kind of loose linking, having nevertheless the interconnection available, completely comprehensive and justifiable on the first ground of possible mutual assistance.

Dump Power Made Available

Through interconnection there is the posibility of using excess power, dump power, as has been done and is being done, but there is not much opportunity in this area. I will speak a little later of utilizing power that otherwise would be thrown away. Then there is another possibility that may be of great value, namely, the alternate expansion of the two interconnected systems. One doesn't just exactly—one cannot, in fact—correlate his next power house unit, or his next power house to the expected requirement. You don't order generators nowadays just to meet the exact cause of your expected expansion. You don't figure that the next year you are going to have another 15,000, 20,000, 25,000 or 35,000 kw. and order a generator accordingly. In other words, you don't order generators the way you order coal. You order them in relatively big hunks—a 5,000-kw. generator is big for a small plant.

In Detroit we are intending to settle down to a 50,000-kw. unit as being about as big as is handy and as meeting our requirements pretty well. They have considerable excess in current-carrying capacity, in kilovolt-amperes, and the turbines have their best point a little below the 50,000 rating—the rating therefore merely conforming to the standards of the manufacturers. The curve of efficiency is still quite flat at 50,000, but the best operating point is between 44,000 and 46,000 kw.

Staggering Activities

NOW, a generator of that size may be just right to carry the predicted increase of load, but at times it may be necessary to have two of them. Once in a while it really pays to put three in at once, three in a row. What can be saved in unit costs by doing things on that scale is quite unbelievably large. Again, there is the commercial instinct affecting me in my position of a manager. I know, for instance, that doubling the capacity at Trenton Channel is going to reduce the unit cost per kilowatt installed by something like $12 to $13, and I know also that when we can repeat these plant units, using identical units, not only can we get a much lower price for the generators themselves from the factory but we can get a much lower total price because we are doing construction work that we have done before—that we have systematized and standardized. Beyond that, from the point of view of the manager, there is the very interesting observation that if we can release certain classes of work, particularly substructure work and steel erection, if we can release these beforehand so they can be done unhurriedly, deliberately and carefully, with everybody working at highest efficiency under

rigid inspection, not only is the work quite a good deal better but the unit cost is a good deal lower.

I don't want to tell tales out of school, but the difference between the cost of a substructure released a year in advance and a substructure put in hurriedly (even from the same plans and by the same experienced crews and as repetition work, so there are no novelties in it) is enough to make the doing of the work in advance very attractive indeed to the manager who can find the money and who can keep the construction organization on hand.

Alternate Construction

All of these things mean that if you have two, three or four interconnected plants, a comparison of construction programs will be exceedingly helpful as it may be decided that this one or that one or the other one for the time being is to be somewhat overdeveloped and the others, by reason of this interconnection, will use the excess capacity. That means that the possibilities of orderly construction are divided to the best purpose among the interconnected companies, that no one of them need be hurried, and that no one of them need be premature. If, for assumption, the companies are all equally capable of financing their construction, the work can be done at the lowest total cost and thereby ourselves and the public can be served to the best purpose.

I think that, after the possibility of mutual assistance, this possibility of what I have called alternate construction is the greatest and most important.

Other Possibilities Outlined

THERE are other obvious things. There is the matter of incidental sales. Somebody's development runs a little bit ahead of his requirements and he finds out which of his neighbors is running low and he can spare him some power and is willing to sell it cheaply. There is the possibility of overhaulage being done and there have been times, I can tell you, here in Detroit when we should have been tickled to death if we could have had 25,000 to 30,000 kw. from some of our neighbors so we could do something that very much needed doing but had to be postponed until we had the capacity excess available of our own. And these are the things, rather than the possibility of continuous selling of current by one company to the other, that are going to justify ultimately the interconnection of all contiguous systems all through the United States.

Interconnections take the form that is the best and most desirable under the circumstances, varying, as I said, from trunk lines that will connect centers of distribution or centers of generation together to merely squirrel tracks of interconnections along the outskirts of the two plants, whereby outlying districts can be passed over pro tem. to the neighboring concern to be supplied with your current. I have sometimes been a party to such swapping of current, it being furnished by us instead of by a neighbor or by connecting lines with which I was associated other than the Detroit Edison Company and have found it exceedingly convenient. These, of course, were interconnections in a sense, but were interconnections of what I call the fringe type.

Now, to study our own area here for a minute, I have said already the cheapest way of moving energy in this neighborhood is in coal cars. That is to say, though present freight rates are double what they used to be, you can put a certain amount of potential energy into Trenton Channel in the shape of reasonably good coal coming up from the South much cheaper than you can generate it near the mines and send it to our points of consumption over any transmission system.

There is also the question of reliability. I do not purpose to go into the technique of reliability, but we know the number of spare lines that have to be available if you propose to depend on high-tension power lines for continuous service. That number is quite large, and of course high-tension alternating-current energy cannot be stored, whereas you can develop a pretty good coal pile on your own lot.

All of our coal, of course, comes from the South. We have some mines in Michigan, but the output is used locally and the output is small. The differential between Ohio and Michigan freight rates is such that there is very little probability of any Michigan plant selling current to the South, all other things being equal.

Diversity Due to Time Zones

But there is one inequality that alters that particular case. Ninetieth meridian time prevails in Indiana and well into Ohio. In eastern Michigan 75th meridian time is used, and it is evident to you that there will be a time in the evening when Detroit, running on 75th meridian time and having the load characteristic of a metal-working district, which is the dominating industrial characteristic in the Detroit electric system, will be dropping its load when the Indiana and Illinois and west Michigan systems are picking up load.

That one-hour step between the time zones of course is exceedingly convenient, but it does work a little to the disadvantage of those cities and communities upon which it imposes a slow clock. The habit and custom of people going more or less by the clock are manifested in that the only way you can persuade them to get up earlier in the morning and go to work earlier in summer is to set the clock an hour ahead—daylight saving, as they call it. That habit sticks out quite prominently in the comparison of load curves between Detroit and Chicago or Fort Wayne, Ind. It becomes evident at once that the industrial areas of north Indiana and northwest Ohio and west Ohio in general might very well indeed utilize power during their peak loads that this area could spare.

Now, of course, Detroit is in the peculiar situation of practically never having an evening peak load. If we have a peak at all, we usually catch it in the forenoon. It comes usually on a very dark, dirty morning, and we seldom have any evening peak, and we don't have any peak of any length whatsoever such as is caused in Chicago and in the 90th meridian towns that lie nearest to the 75th meridian zone. That is to say, those towns in which the 90th meridian time means a slow clock have a peak due to the overlapping of the lighting load with the industrial power load. It is becoming evident that there may be conditions in which current generated at actually higher costs may be deliverable into that territory profitably, because delivering that current will mean that a plant already in existence can be used and it will be unnecessary to build a local plant in order to take care of that evening peak load.

That difference in time zones is going to cause and has already caused a shifting of energy through inter-

connections across zone lines in a way that is going to be helpful to all the parties, because the investment costs are going to be kept down thereby. Whether the thing will go so far as to have current generated in or near Detroit used to help out the plants at the south end of Lake Michigan remains to be seen. I don't hardly think it. I think all the economical conditions as we know them are rather against that; but current generated in the 75th meridian zone in Ohio will inevitably be delivered into the eastern side of the 90th meridian zone and is being already so delivered. That, of course, means improved load factors for the generating plant. It also means improved load factor for the receiving plant, because the existing plant will be loaded and there would not be required an addition to the denominator by which the total output must be divided. That is to say, the plant in that district will be well loaded, and the plant in the 75th meridian district will have an improved load factor.

Load Factor Improvement Essential

Load factor is the most serious consideration before us as managers today. We have been faced through a long series of years with rising investment costs. The cost of everything is up. The cost of labor and material has gone up. There is an arrest of that rise at the present time. Unit costs of power plants are even tending to decline. Unit costs of various constructions in terms of the availability of those constructions are also tending to decline. That is due largely to improved engineering. It is also due to conditions of the market that have causes outside of engineering, but until very recently the ratio of investment to gross earnings of all of our large plants was getting worse. We were taking a longer time to turn over the capital. We were approaching a business condition where, instead of, say, a maximum for a well-balanced, conveniently arranged property of $4 of capital to $1 of annual gross earnings, it was soon going to require $5 in capital. Remembering that operating ratios are such that we need from one-third to 40 per cent of our gross earnings to meet fixed charges, you will understand that a business in which the fixed charges tend to run up much more rapidly than the earnings is a very grave condition. Interconnection, so far as it modifies or ameliorates that condition, is going to be a very great help to us.

Unit Price Trend Downward

Reduction of first costs, within reason, is one of the most important engineering problems of today. I am occupying the point of view of the man who has got to raise the money. I do not mean skimping the cost of constructing a plant by making a plant that is hard to operate and costly to maintain—a plant in which you cannot keep the men because it is so inconvenient. I don't mean that at all, but do contend that building a really first-class plant that men are glad to operate and which they can maintain at the initial efficiency for lower costs than have heretofore been common is the biggest problem we have before us today. The other face of that same problem is the finding of greater usefulness for the existing plants—in other words, improving the annual load factor. To whatever extent these conditions are helped by interconnection, it will be an unqualifiedly good thing.

You will remember, of course, that the unit price at which our output is sold is down. It is down to pre-war figures—down below pre-war figures in many cases. The service that is represented by the sale of 1 kw.-hr. of residential service, or commercial, or industrial, is delivered now for the same price or at a lower price than before the war. The downward tendency is inevitable. It is helpful in that it is increasing sales.

Lower prices for our service may yet be warranted because the law of diminishing returns has not yet become controlling. The actual reasons why our prices are lower are, first of all, that our costs are lower, and that is due to some extent to improved engineering and to some extent to conditions of the markets that have reduced the unit cost of construction. Secondly, it is due to the greater use of our service, to the education of our public and development of new uses—uses that were undreamed of six or seven years ago. All of these causes have tended to a greater utilization of our output and thereby to improved load factors, to production on a larger scale, to the possibility of building larger power houses at lower unit cost, and so forth.

Water-Power Resources of Rumania

THE Dec. 6, 1926, issue of *Commerce Reports* contains the following article by United States Consul Ely E. Palmer, stationed at Bucharest, Rumania:

Plans have been drafted with a view to the electrification of Rumania in collaboration with foreign capital and foreign specialists, pending which all energy resources of the country were inventoried in accordance with the provisions of the "energy law." One of the chief obstacles has been the question of financing the project, although the establishment of the Société Nationale de Crédit Industriel in 1924 has somewhat remedied the situation. The total annual energy consumption of all Rumanian industries is estimated at about 900,000 hp.

POWER RESOURCES OF RUMANIA

Source	Quantity	Horsepower
Coal (annual production, 1924), tons	3,365,515	1,121,837
Petroleum, tons	1,860,000	935,400
Natural gas (annual capacity available), cu.m	375,000,000	250,000
Oil-well gases, cu.m	400,000,000	90,000
Waters:		
Lowest available power, total		1,672,980
Banat		112,980
Transylvania		660,000
Iron gate region (Danube)		250,000
Old Kingdom		650,000

Rectifier Installation for Railroad Service

RECTIFIERS for use in connection with the electrification of the Metropolitan railroads of Berlin are notable not only for their mean continuous output (1,200 kw. per unit, corresponding to 1,500 amp. at 800 volts) but for the required overload capacity. The exceedingly rapid succession of trains causes a rectifier load of 3,000 amp. during 40 seconds, followed by 300 amp. during 50 seconds, this process being repeated every minute and a half. The load in question is therefore 3,000 amp. with only momentary light-load interruptions. The rectifiers will be installed in 40 small substations along the line at the point where peak loads

occur. The substations will be built into and below the arches of the viaducts and will feed directly into the two third-rails, so that costly feeder cables may be dispensed with.

For economical operation it is of importance that the efficiency of the electrical equipment remain as high as possible during periods of low load, as the switching in and out of the unit, which is possible in the case of centralized conversion according to the energy required, would be too complicated here on account of the quick succession of demands and the large number of stations entering into consideration. These conditions are met by the rectifiers satisfactorily, and their further outstanding features—such as the small space required, low weight facilities for transport, absence of vibration, foundations and rotating parts, noiseless running and maximum overload capacity—appear all in favor of the apparatus for applications of this kind.

Letters from Our Readers

Confusion Caused by Difference of Viewpoint

To the Editor of the ELECTRICAL WORLD:

There is an old saying "It is the difference of opinion that makes horse racing." To paraphrase this, "It is the difference of viewpoint between the engineer and the accountant that makes confusion." The reason behind this confusion is largely psychological. Mr. Engineer constantly is estimating values and dealing in approximations. When he estimates, his slide rule furnishes him a wealth of approximations. These he welds into a final approximation which he very correctly terms an estimate. Percentages serve every practical problem sufficiently. Theory and practice prove to him that close approximations spell engineering accuracy in the final results. His viewpoint is influenced by his common trend of thought. He thinks of $9.99 as $10.00 and is mentally out of harmony with Mr. Accountant, who insists on expressing the pennies as well as the dollars.

The color and background of the work of Mr. Accountant groove his general thought in a different direction. He is constantly dealing with exact figures. When he records the result of his computations, because of the set-up of his books, he must use the exact values. These values he obtains with the aid of a calculating machine. He is constantly using data in its ultimate refinement. He borrows money from his bank on the strength of a balance sheet showing not round amounts but exact conditions. He sends Mr. Engineer a bill for energy consumed at the exact computation. If Mr. Engineer were to receive a bill for his lighting current which read: "To energy consumed, about $6.50," Mr. Engineer would not pay it. When the bill is sent out as $6.49, it is paid without question. When the accountant records purchases, he posts pennies as well as dollars. Thus the psychological effect of his duties makes him think in terms of exactness. When Mr. Accountant with his calculating machine and Mr. Engineer with his slide rule meet in conference, each should know the why of the other fellow's logic, which is the background of their use of the different tools.

In addition to the largely psychological inability to grasp each other's viewpoint, another reason for cooperation exists. Confusion oftentimes becomes chaos when each glibly patters in the terms of his own profession. How often have you heard Mr. Accountant explain to Mr. Engineer a bookkeeping entry upon which Mr. Engineer seeks light: "Expense applicable to a subsequent period"; "debits to account 742"; "the debit side of the asset . . ."? Each phrase rolls glibly off the tongue of the orator, to the utter confusion of his audience. And Mr. Engineer—he mentions "the turbine hall." His innocent auditors make their own picture. Later there is a reaction. They find he means a room in which he houses his turbines. They wonder whether the boiler room will soon receive a like nomenclature. "Bleeding steam," "phasing the system," "calibrating the meters"—thus his patter runs riot.

The limits of accuracy required should be understood. Mr. Engineer and Mr. Accountant can provide the remedy themselves. The meeting of minds must be accomplished by realizing that the other fellow has a solid viewpoint. Mr. Engineer must school himself to remember that, in the final analysis, the accountant exists only to show the owners how much larger the profit and loss is during this period than in the last period. He must think what his reactions would be were his monthly salary check of $666.67 made out in the round amount of $650. Mr. Accountant likewise must not permit his vision to become warped. He must bring himself to understand that when the engineer wants to know the amount of coal on the system 32,000 tons expresses the desired information much better than 31,943.82 tons. Both men realize that, except within the confines of their own profession, simple terms, homely English, will often bring understanding out of chaos. "Aqua frigida" can be referred to as ice water without lowering the dignity of the lecturer.

While the realization of "the psychological impulse" and the elimination of insular terms will go far in helping to solve existing difference, a third step of considerable educational value would be to have the accountant meet the engineers at the latters' various conferences and committee meetings. Mr. Engineer, too, should be occasionally invited to attend the mental feasts of the accountants. At present, indeed, joint meetings of engineers and accountants are held, particularly in the public utility field, but the general practice at these meetings is for an accountant to submit a detailed report which in the main is comprehensive only to his brother accountants, while the engineer addresses his highly technical paper to his brother engineers, the effect of the joint meeting being apparently only that Mr. Jones, accountant, knows there is an engineer named Mr. Brown.

Were Mr. Accountant to present some of his practical problems involving engineering contact and explain why on some occasions it is necessary for him to appear in the light of a complete nuisance, much good would result. The accounting bodies, on the other hand, should have the engineer explain to them some practical instances where the accountants have lived up to their reputation for accuracy at the sacrifice of logic. A much clearer understanding of the other fellow's purpose will be accomplished if only we constantly will seek the "giftie" which will enable us "to see oursel's as ithers see us."

JOHN A. ALLEN,
Cashier.
Narragansett Electric Lighting Company,
Providence, R. I.

Central Station and Industrial Practice

Analysis of Instrument Transformer Errors

BY CARL W. EVANS

IN THE metering of primary circuits, making use of instrument transformers in conjunction with watt-hour meters, there are two possible sources of errors. These are due to the ratio of the transformer and the phase angle, which vary with the load and also with the power factor of the circuit.

In recent times the testing of instrument transformers by primary methods has been superseded by the use of the Silsbee testing sets, requiring only an electrician or meter tester of average intelligence and only ten or fifteen minutes to complete a test. These instruments give directly the per cent of marked ratio to the ratio of a standard transformer. The phase angle is read directly in minutes and is designated as leading or lagging. It remains, however, to establish a criterion for determining at what point a transformer should be condemned, which of course depends upon the error which it introduces into the metering circuit.

The error in the metering circuit, due to incorrect ratio of a transformer, is simple enough to determine. If the ratio of a transformer, for example, was found to be 99 per cent of the marked ratio of the standard transformer and the curve for the standard showed it to be 100 per cent correct at this point, the error would amount to 1 per cent. From this it is seen that the per cent error varies directly with the ratio error. If per cent error is plotted against the quantity (100 per cent = per cent of marked ratio), it will be found to be a straight line with the abscissa at any point equal to the ordinate at that point.

The error due to the phase angle of transformers does not vary directly with the phase angle, but is dependent also upon the power factor of the circuit. This is shown as follows:

The power in the external circuit is

$$P = EI \cos \theta$$
$$= R_e R_i E_1 I_1 \cos \theta$$

where $R_e R_i$ are the ratios of the potential and current transformers respectively, and $E_1 I_1$ are the voltage and current in the meter circuit. The power registered by the meter, however, is

$$P = R_e R_i E_1 I_1 \cos (\theta - a + b)$$

where $(a + b)$ is the resultant phase angle of the transformer combination. a and b must of course be corrected as to sign—that is, positive if leading and negative if lagging.

If it is assumed that the power factor remains constant, the per cent error, x, will be

$$x = 100 - 100 \frac{\cos (\theta - a + b)}{\cos \theta}$$

and the variation of the per cent error will be

$$\frac{dx}{d(a+b)} = \frac{100 \sin (\theta - a + b)}{\cos \theta}$$

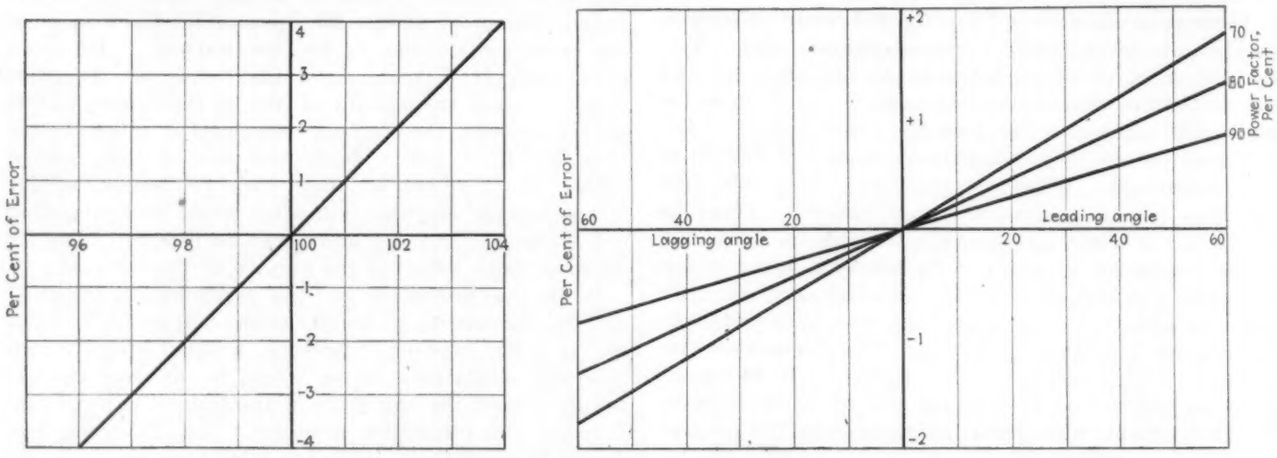
from which it is seen that the error depends upon both θ and $(a + b)$. If, however, θ is zero or nearly zero, x varies as $\sin (a + b)$.

When θ is 90 deg. or nearly so, $\frac{dx}{d(a+b)} =$ becomes

$$\frac{dx}{d(a+b)} = \frac{100 \cos (a+b)}{\cos \theta}$$

and x varies as $\cos (a + b)$. If $(a + b)$ is small, as it is in well-designed transformers, the graph between x and $(a + b)$ will be approximately a straight line. If their relations are plotted for various power factors, the tester is enabled to determine exactly the per cent error that will be introduced into the metering circuit. This error will be negative irrespective of the resultant phase angle, whether it be leading or lagging. (By positive or negative is meant the relation of the power registered to the true power in the external circuit. This error is understood to be positive when the meter registers more than it should).

The magnitude of the error in a metering circuit depends upon the number of transformers and the sign of the error, whether it be positive or negative. If the transformers are all of like characteristics, the error in the circuit will be the sum of the individual errors of the transformers plus the error of the meter. As an example, in a three-wire, three-phase metering circuit there are two current and two potential transformers. If the errors of the transformers and the meter is within 1 per cent, yet all of the same sign, the maximum error



RELATION OF PER CENT ERROR IN METER CIRCUIT AND RATIO ERROR AND OF PER CENT ERROR AND PHASE ANGLE OF TRANSFORMERS

may be as high as 5 per cent. From this it will be seen that transformers need not be condemned even if their respective errors amount to as much as 2 and 3 per cent, since by properly matching them in the circuit the error of one may compensate for the error of another and a high degree of accuracy be obtained. This, of course, presupposes a condition of average load balance.

It will be noted also that by proper design the ratio error may be made to compensate for the phase angle error, increasing the accuracy of the transformer as a unit.

Standard Oil Piping for Transformers and Circuit Breakers

The Alabama Power Company Makes the Installations in All of Its Plants and Substations Conform with a General Standard

TO PROVIDE a definite standard for transformers and circuit breakers of oil-piping systems the Alabama Power Company has adopted specifications of materials and arrangements. These specifications apply to all generating stations and primary (44-kv. and 110-kv.) substations.

The general arrangement of the oil-piping systems conforms to the typical layout shown in the accompanying illustration. Where the size of the station does not justify the complete system shown, such piping as is installed conforms to the corresponding parts of the typical layout. In the larger installations two oil storage tanks are provided, one for transformer oil and the other for circuit-breaker oil. In the smaller installations, however, it is not economically feasible to install two tanks. The bypass valves shown at *A* and *B* are provided to circulate and purify the oil standing in the system before the oil in any equipment is purified.

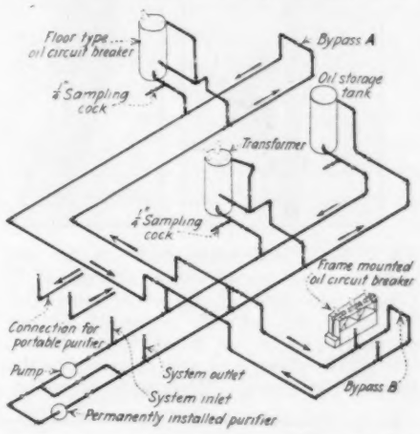
Headers, in general, are laid at a depth of 18 in. below the ground surface except for power transformers, in which case they are laid on the concrete mat around the transformers. Return valves and connections installed 12 in. above the ground level are located as shown or in such a way as to permit filtering of oil in all pipe runs. Branch-line valves, such as valves connecting 44-kv. and 110-kv. yard lines to the header, are installed 12 in. above the ground level. Valve hand wheels on all lines leading from the oil purifier are painted with red enamel, whereas those leading to the purifier are painted green, and bypass hand wheels are black.

The specifications call for standard-weight wrought-steel galvanized pipe and standard-weight malleable-iron galvanized fittings and unions. Throughout the piping system no valves other than 1 in. and 2 in. are used except where valves of other sizes are furnished by the manufacturers of the apparatus to which the piping connects. All threads are thoroughly covered with a medium thick paste of litharge and glycerine before being screwed up. All pipe runs and connections are tested by application of air pressure at approximately 20 lb. per square inch before being put into service or covered.

Connections for Oil Purifiers

Connections to permanently connected filter presses or centrifugal purifiers are made with 2-in. pipe connections to the pump inlet and the purifier discharge with a bypass arrangement. Where no purifier is permanently installed, provision is made for a portable purifier by 2-in. connections to the inlet and outlet headers of the system.

Every transformer rated at 100 kva. or larger is provided with one 2-in. pipe connection at a point in or near the top and a 2-in. outlet connection to drain from the lowest point of the tank. In addition, every transformer of 500-kva. capacity or more has a 2-in. connection approximately 24 in. above the draining point. In the case of conservator-type transformers the inlet connection is made at the top of the conservator tank instead of near the top of the transformer.

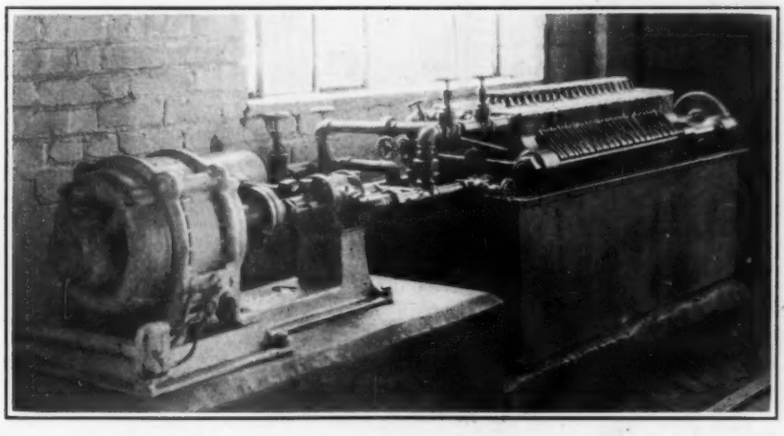


TYPICAL OIL-PIPING SYSTEM USED IN THE PLANTS AND SUBSTATIONS OF THE ALABAMA POWER COMPANY

Power transformers of less than 100 kva. and more than 10 kva. are similarly connected except where two or more are grouped close together, in which case they are treated the same as frame-mounted oil circuit breakers.

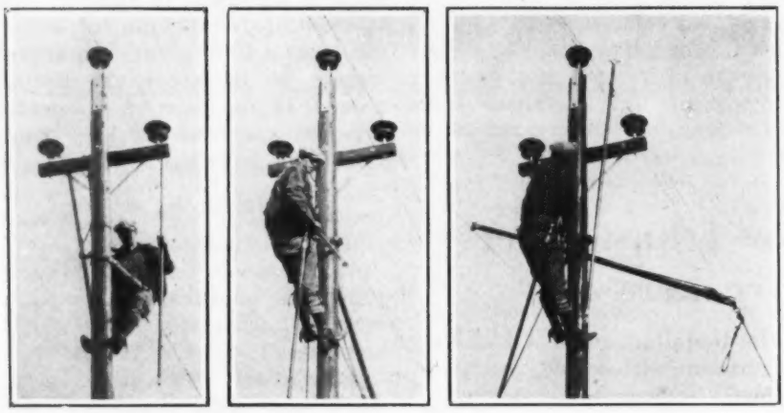
Power transformers of less than 10 kva. are not provided with oil connections. Instrument transformers having primary voltages of more than 44 kv. are treated as power transformers of 100 kva. or larger, and instrument transformers of 44 kv. or less are connected like frame-mounted oil circuit breakers.

In all floor-mounted breakers, the oil outlet is at the bottom of the tank



OIL FILTER PRESS IN THE MAGELLA SUBSTATION, ONE OF THE MAIN SOURCES OF SUPPLY FOR THE CITY OF BIRMINGHAM

Changing an Insulator on a Hot Line



AT THE left, ready to start the job. Center, wire tongs strapped in place, one side of tie-wire loose and about to be cut off to avoid hitting crossarm, pole or hardware. Right, line in the clear and new insulator with tie-wire in place. Tools used were 10-ft. 2-in. wire tong, 8-ft. tie stick, 4-ft. wire cutter, pair of ½-in. rope blocks, ½-in. hand line and pole strap for tying tong to pole. These pictures were furnished by Floyd F. Gateka, Southwestern Light & Power Company, Altus, Okla.

and the inlet at the top. In some types of floor-mounted breakers an extra inlet is provided approximately 12 in. above the outlet, which permits filtering or purifying the lower portion of the oil. With frame-mounted oil circuit breakers each 2-in. inlet and outlet header has a 1-in. riser, terminating in a 1-in. globe valve, the center of which is 12 in. above the circuit breaker foundation.

For use with these oil connections there is provided at each station two suitable lengths of 1-in. flexible metallic steam hose, each length being fitted with a female brass-hose coupling on one end and a male hose coupling on the other end.

Use of Live-Line Tools

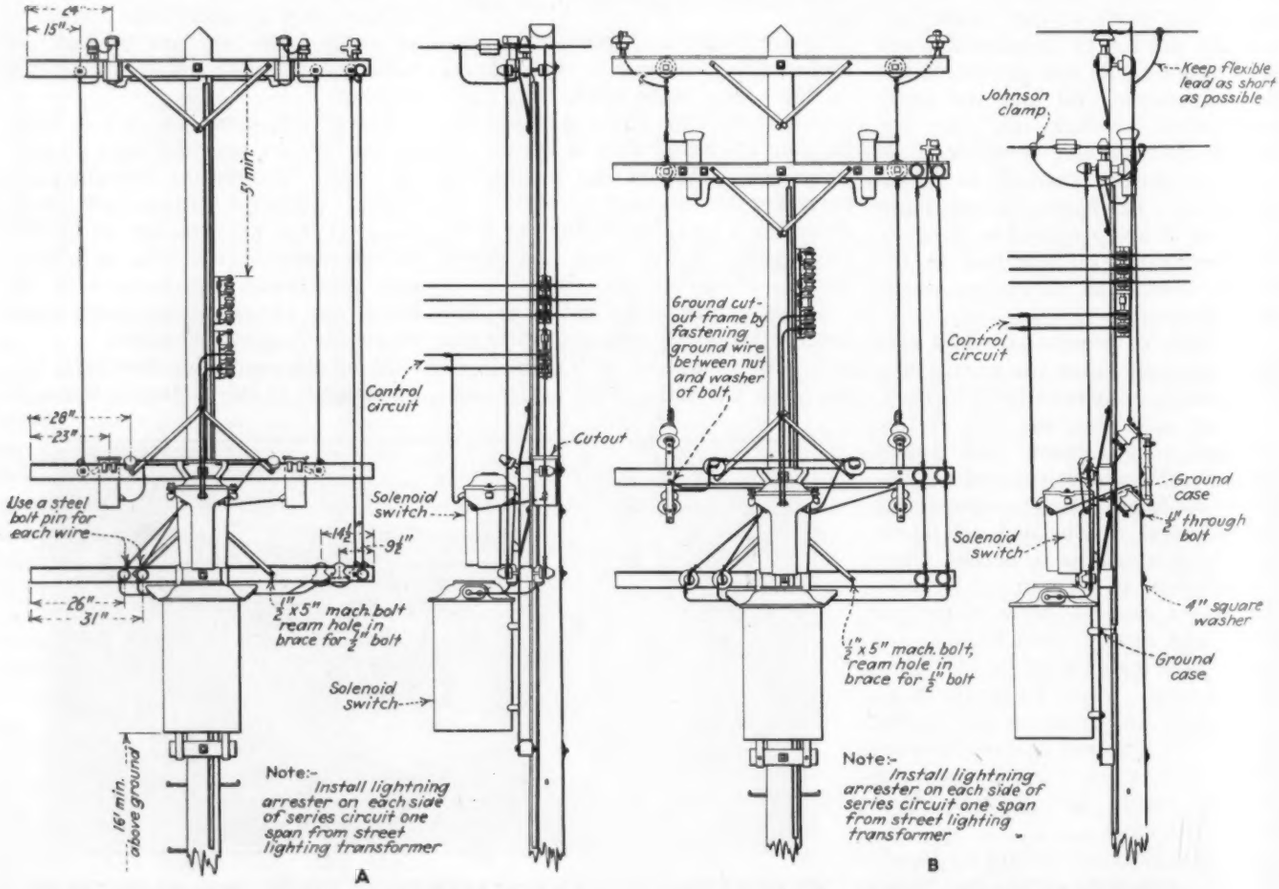
BY HARRY O'BRIEN
Superintendent of Transmission Lines, Indiana Service Corporation, Fort Wayne, Ind.

TAKING as a basis the idea embodied in Cronin live-line tools, some of the men in charge of transmission work on the Indiana Service Corporation's lines have developed a set of tools that permits working on hot lines with a high degree of safety and at almost the same speed as if the lines were dead.

The first consideration in the de-

Constant-Current Transformer Installation

THE TWO standards presented here were recently issued by the West Penn Power Company. *A* shows a 2,300-volt constant-current transformer installation with a 25-kva. or smaller transformer. *B* shows the same but for a 6,900-volt transformer. At least a 40-ft. pole is specified for these installations.


24"
15"
5' min.
28"
23"
Use a steel bolt pin for each wire
26"
31"
Control circuit
Cutout
Solenoid switch
14½"
9½"
1" x 5" mach. bolt ream hole in brace for ½" bolt
Solenoid switch
16' min. above ground
Note:- Install lightning arrester on each side of series circuit one span from street lighting transformer
A
Ground cut-out frame by fastening ground wire between nut and washer of bolt
1" x 5" mach. bolt, ream hole in brace for ½" bolt
Note:- Install lightning arrester on each side of series circuit one span from street lighting transformer
B
Johnson clamp
Keep flexible lead as short as possible
Control circuit
Ground case
1" through bolt
Solenoid switch
4" square washer
Ground case

EXAMPLES OF CONSTANT-CURRENT TRANSFORMER INSTALLATIONS ON 2,300-VOLT AND ON 6,900-VOLT SERVICES

velopment was to make a set of tools that would give the maximum amount of protection to the men and at the same time relieve those on the pole from as much of the heavy work as possible in connection with clearing the pole of high-potential lines. This was accomplished by placing two clamps on the pole which form a guide for a riser. An arm on which are mounted insulators with an automatic locking device is fastened to the top of the riser beneath the line. This assembly of riser and arm is then ready to be raised or lowered by means of a block and tackle, with the fall line handled by a man on the ground. When this part of the work is done, the linemen move the insulators in a slide provided on the arm to a position directly under the line wires. The line riser is then raised until the wires are locked in the temporary insulators, after which the line is untied.

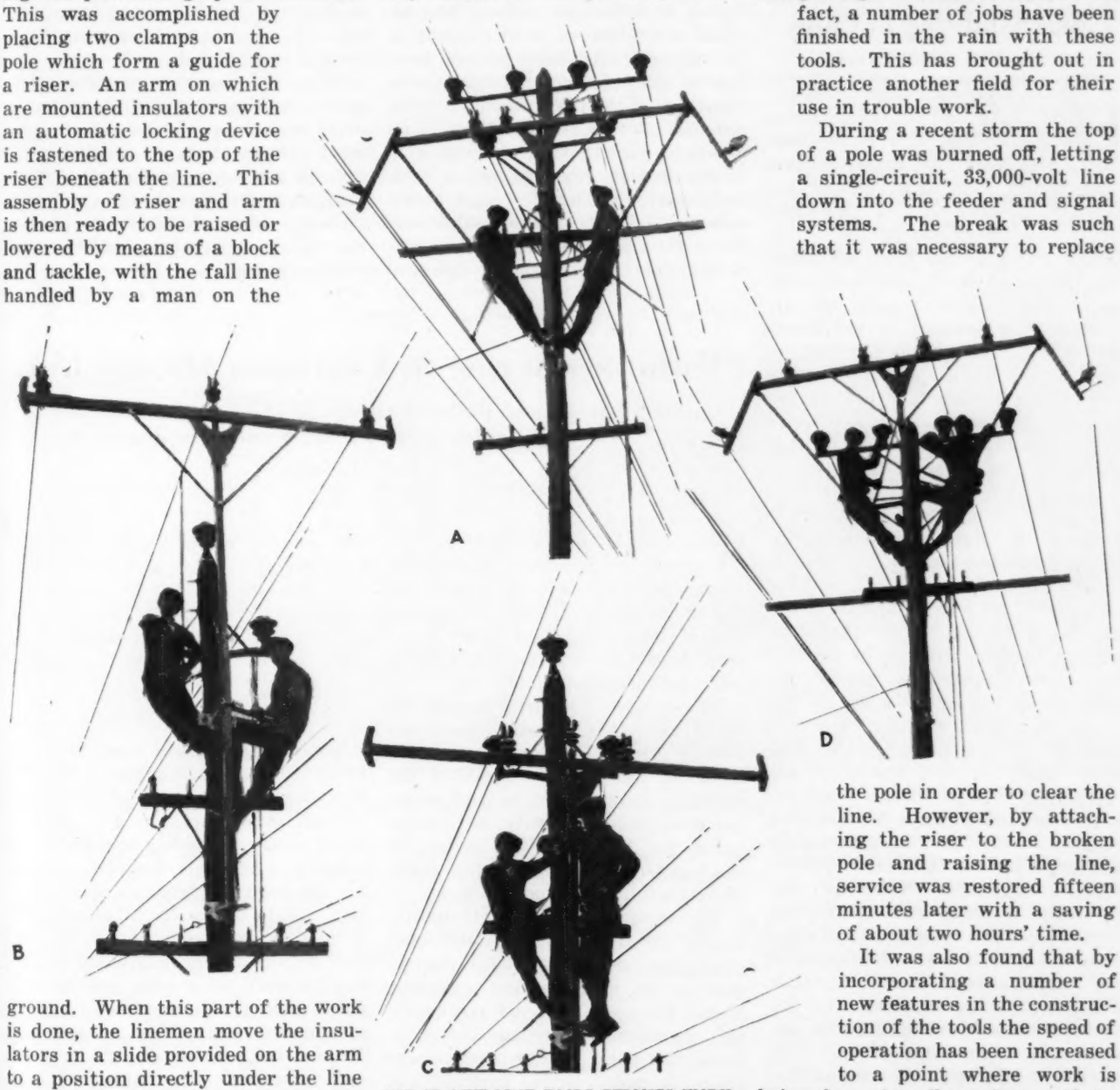
When this step is completed, the conductors are raised to a position that provides ample clearance for the men working on the pole. Before starting work, however, the linemen lock the riser in place so that there is no possibility of it being accidentally lowered. As a further precaution the fall line is snubbed around the base of the pole. Upon completion of the work the process is reversed and the lines are not released from the lock until they are tied in on the permanent insulators.

The locking feature has proved very successful in practice, as it provides a high factor of safety. A number of cases of decayed pins were found that broke off before being untied. With this device as soon as the live wires are locked in both men on the pole are free to untie and tie it again with a minimum of danger.

Another feature of importance is the use of standard porcelain insulation, which removes the hazard of being caught in wet weather. In fact, a number of jobs have been finished in the rain with these tools. This has brought out in practice another field for their use in trouble work.

During a recent storm the top of a pole was burned off, letting a single-circuit, 33,000-volt line down into the feeder and signal systems. The break was such that it was necessary to replace the pole in order to clear the line. However, by attaching the riser to the broken pole and raising the line, service was restored fifteen minutes later with a saving of about two hours' time.

It was also found that by incorporating a number of new features in the construction of the tools the speed of operation has been increased to a point where work is being done virtually as fast as if the line were being handled cold. Use of these tools by the line department of the Indiana Service Corporation during the last ten months has effected a considerable saving in the labor cost of rehabilitation and maintenance work in addition to the greater safety provided. So far the application has been limited to use on single and double-circuit lines of pin-type construction, but it is believed that it can eventually be extended to even greater advantage.



USE OF LIVE-LINE TOOLS PERMITS WORKING ON HOT LINES WITH HIGH DEGREE OF SAFETY AND AT ALMOST SAME SPEED OBTAINED ON DEAD CIRCUITS

A—Line riser held in position on pole by two clamps which serve as guides.
B—Line riser in position, allowing ample clearance for work on pole.
C and D—How riser is adapted for use on different kinds of pole-top construction. Note use of automatic locking device for holding wires.

Commercial Activities and Public Relations

Doorbell Ringing Not Good Merchandising in Cities

BY A. C. MCMICKEN
General Sales Manager Portland Electric Power Company, Portland, Ore.

FROM both a public relations standpoint and also a merchandising standpoint, the writer believes that utility companies should not conduct doorbell-ringing, house-to-house canvassing campaigns in the larger cities unless they are offering their customers something new, useful and unique. Usually the city housewife is annoyed by canvassers selling articles of all descriptions, and she resents the salesman of the utility ringing the doorbell to sell flatirons, percolators, toasters, or other established household electrical appliances. She resents the intrusion and feels less kindly toward the power company for it. If a kitchen-unit lighting campaign is being conducted for the first time or some similar device is being offered which will get her immediate interest, the condition is not the same, and such campaigns may be justified and prove successful under the house-to-house canvass plan.

Careful consideration, however, should be given to the public relations angle of the house-to-house campaigns in large cities. There are numerous other ways of securing prospects that can be successfully employed by the salesman without ringing doorbells. Newspaper advertising, direct-by mail advertising, return post-card campaigns and many other methods are at the disposal of the merchandise sales manager, which will bring inquiries that can be very properly followed up by personal calls of the salesmen and without the risk of jeopardizing customer relations.

Neighborhood Cooking Schools

A MODIFICATION of the public cooking-school plan has been put into effect by the Lorain division of the Ohio Public Service Company with marked success. Instead of having the large affairs that have become standard, arrangements were made for small group demonstrations in the homes of selected customers. Four meetings were arranged at the homes of influential women, who invited a number of their friends to be present. A demonstrator from one of the appliance manufacturers, together with the company's own demonstrator, conducted the demonstrations, paying particular attention to the use of small appliances such as electric waffle irons and percolators. No mention of sales was made, the entire idea being to demonstrate the convenience of electrical appliances. In all, approximately 60 women attended the demonstrations, two of whom are known to have bought appliances later.

It has been found that in the small group meetings the women will ask more questions and can be given more definite answers than is the case in the larger gatherings. The questions are found to cover all sorts of appliances, from the smallest up to washers, cleaners and refrigerators.

Human Interest in Customer Ownership

Unusual Instances of Building Habits of Thrift and Confidence in Utility Remove Routine from Security Selling

BY C. E. YACOLL
Manager Securities Department Pennsylvania Ohio Power & Light Company, Youngstown, Ohio

SELLING of securities to customers has become virtually universal among electric light and power utilities. Every company does it, and means and methods are well standardized. The job is being well and adequately done.

The customer security buyer has no occasion for regret. He is receiving from his investment just what he was led to expect—a dependable income if he bought notes, bonds or preferred stocks, or perhaps a run for his money if he bought the less frequently offered but somewhat speculative common stocks.

The company has the customer's money for investment in additional equipment or other useful money-making or money-saving purpose; it has his good will and frequently his pronounced partisan interest. Score that point for customer ownership. It makes active partners out of passive friends who might or might not have been mildly appreciative of good service.

We have made almost a routine job out of the whole affair, and of routine jobs we see merely the task to be done and the immediate result.

This is our every-day angle of vision toward customer ownership; but there is another and vastly more interesting slant on what is accomplished when a utility sells its bonds or stocks to various and assorted individuals, the view of the job that will make it look different, be everlastingly new and of perpetual interest. The company has sold its stocks and with the proceeds built a transmission line or installed another turbine—mere routine, but frequently it has done more.

CHARACTER BUILDING

Jim Kidder (names mean nothing here) is one of our foremen, a thrifty New Englander. An eighteen-year-old son four years ago gave him a lot of worry. The boy had the auto complex. Like his dad, he worked for the company, and his sole ambition was to own a car when, as and if he ever got enough money to buy it. As the father expressed it, he had "a devil of a time getting the kid to sign up for a couple of shares of company stock," but sign up he did, probably with fingers crossed and a mental reservation to the effect that the saved money would eventually pay for the car he wanted. We knew nothing about the "inside" of this initial purchase of stock and it was pure routine until recently the father told us the outcome.

The son now has a thousand dollars' worth of stock on which he could immediately realize, but the purpose of his saving has radically changed. At his suggestion that the youth now buy the car, Kidder senior was told that the serious saving schedule now in effect allowed

for no autos for some time to come; the securing of additional stock was of most importance; the car was not immediately needed and could wait.

At eighteen "Jim" was standing to fall in any direction. Employee ownership (and his father) propped him up on his weak side, taught him a proper sense of values, gave him a worth-while start toward personal independence. It built thrift, ambition, a sense of responsibility into his character.

Another instance. You would guess from looking at this 84-year-old Civil War veteran that his name was Hezekiah, and maybe it is. He had owned a little grocery store for enough years to allow him to lay up sufficient money to live on, if he continued to live carefully and if the income could be increased a bit over that paid by his bank. Real estate mortgages sounded safe and they paid 6 per cent. He gave several thousand dollars to a man for investment in a first mortgage and felt perfectly secure in his investment until the man who was supposed to have placed his money turned up missing and those thousands were gone. A venture with some vacant lots which were to show a quick profit reduced Hezekiah's capital and entire worldly wealth to $4,000 and a little home.

Some years ago we placed his investment funds in light and power stocks and his income is now assured. His first two experiences had left him broken and bitter, but he has since renewed his faith in mankind and is as trustful as ever.

There have been intervals when we have had nothing to sell—our shelves have been bare. A well-to-do farmer, with his wife, came in one day looking for an investment and we had nothing for him. He had never bought from us and really knew nothing of the company or our method of doing business, except that his neighbors had recommended us. His initial deposit with us was $3,000, added to several times in the next two or three months, all to be invested in our stock when and if available.

This experience has now become commonplace. Regular buyers and others frequently leave money with us to be invested when stock answering their requirements is available. This is because a trustworthy industry has played fair with them and their neighbors and because the contacts of the customer-ownership department with them have established a feeling of confidence and security.

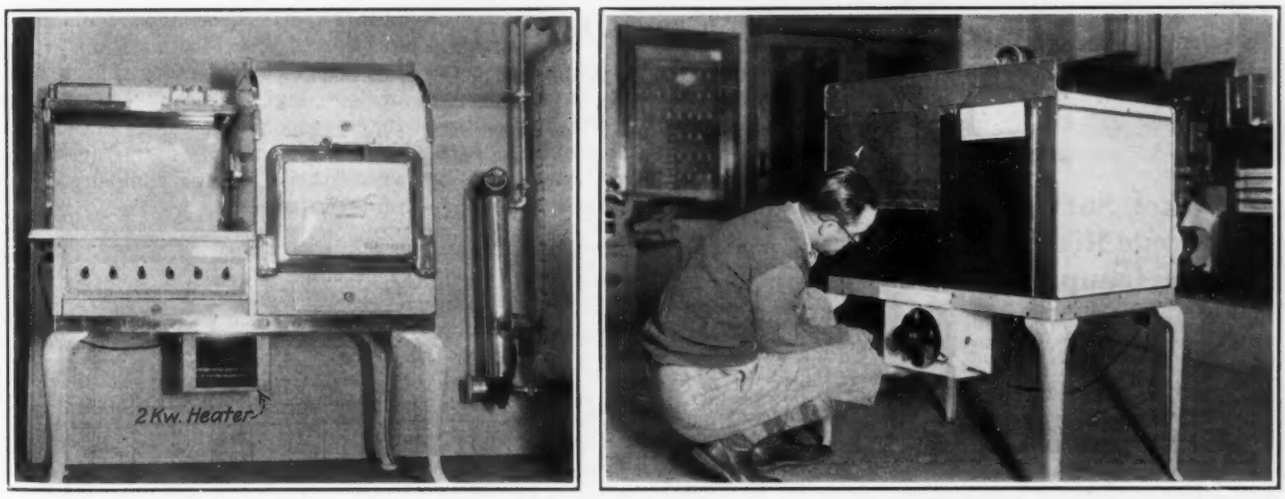
Taught Value of Money

Fear, distrust, lack of knowledge, all or any of them, keep millions of uninvested funds out of the banks where they properly belong—and the education of the owner of hidden money through customer ownership has put many thousands of moldy dollars to profitable work.

We have all had the experience of recovering bills so long and so securely tied that they could scarcely be straightened out for counting, of currency smelling of the damp earth from which it was dug, of gold which had become dull through years of inactivity from being hidden away. Customer ownership has brought these dollars out and converted them into productive servants of their owners, who in many cases for the first time have learned the advantage of investment income. All these things and others equally worth while are the products of the sale of securities to customers. The cut-and-dried commercial experience becomes a thing alive with human interest when viewed from this other angle.

Combination Heater and Fan Mounted on Electric Range

THE problem of warming the kitchen when an electric range is sold apparently has been solved by H. H. Courtright, president of the Valley Electrical Supply Company, Fresno, Cal., by installing a 2-kw. heater under the range and selling the range and heater as a unit. An important feature of the heater is that an 8-in. fan is used to force air through it at a rapid rate, thus raising the temperature of all the air in the room at a more rapid rate than can be done with heaters of the ordinary type.



2-KW. HEATER WITH FAN SOLVES PROBLEM OF HEATING KITCHEN. CONSUMPTION WILL ALMOST EQUAL THAT OF RANGE ITSELF

Tests show that this combination of heater and fan will raise the temperature of the air in a kitchen at the rate of 1 deg. per minute for the first fifteen minutes, after which the rise is more gradual. Thus a kitchen at a temperature of 45 deg. in the morning will be brought up to 60 deg. in fifteen minutes—a temperature at which it is comfortable to work. A switch mounted on the heater permits the element to be turned off so that the fan may be used for cooling the kitchen in the summer.

The heater and fan are made up

as a unit as illustrated and installed on the range in the manner shown. The heater cord is plugged into the convenience outlet on the end of the range. The first of the heaters to be made up cost about $20. It is the plan of Mr. Courtright to include the heater in the selling price of the range by raising range prices and selling the range and heater as a unit only. If a purchaser does not want the heater, there will be no reduction in the price of the range.

Not only does this arrangement take care of the problem of heating the kitchen but it will reduce the tendency to install trash burners on the end of the range, and perhaps, most important of all, it will practically double the consumption of a range customer. For instance, if the heater is used an average of an hour and a half a day the year around the monthly consumption will be 90 kw.-hr., making the consumption of the range and heater combined approximately 215 kw.-hr. per month.

Market Survey Should Precede Merchandising Campaigns

By A. C. McMicken
General Sales Manager Portland Electric Power Company, Portland, Ore.

TO THE knowledge of the writer electric utility companies that merchandise on a large scale in all of the territory they serve have never had an outside agency make a real market survey looking toward the intelligent planning of merchandise-selling campaigns. It seems to have been the general policy to plan campaigns that were conducted uniformly for all divisions of the utility's territory without any particular study or analysis indicating whether or not the article to be merchandised had a real market in all of the cities and towns to be covered by the campaign.

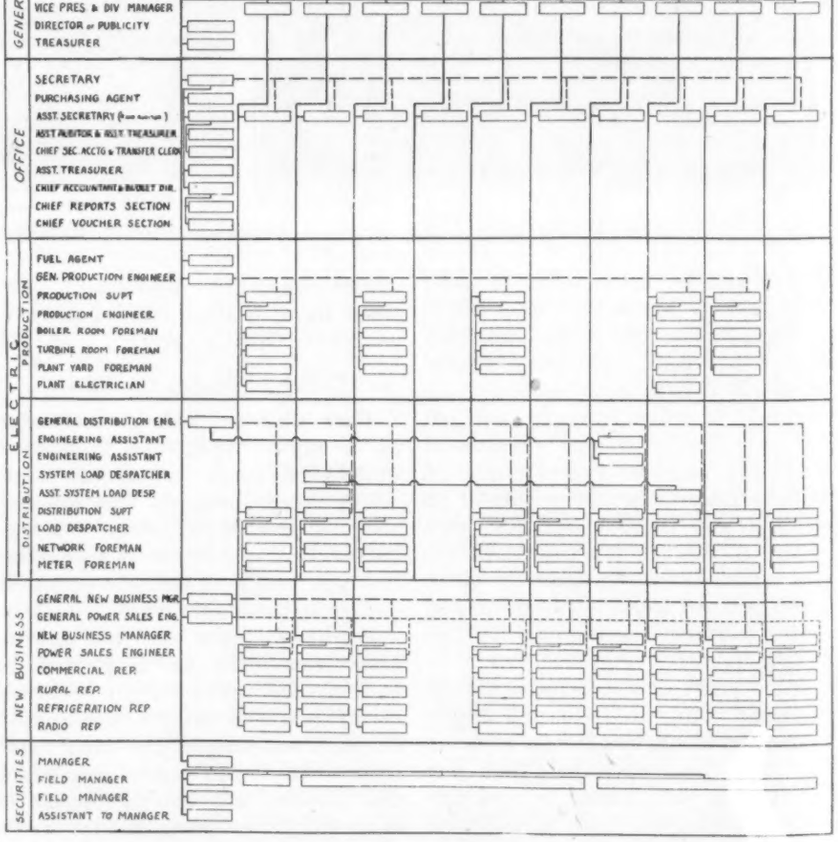
It is a well-known fact that national advertisers—that is, manufacturers of given products—before introducing their product in a territory not only have market surveys made by the newspapers and periodicals whose pages they expect to use in reaching the public but also have market surveys made by their advertising agency or some firm or individual that specializes in market analysis.

Likewise it would undoubtedly pay many of the larger utility companies to employ some one outside their organization capable of making intelligent market surveys to carefully analyze all of the territory by divisions or towns and thus have an intelligent and unbiased knowledge of conditions so that in planning campaigns greater success will be enjoyed. It does not follow because a range campaign is planned for June that ranges may be or could be expected to sell with equal facility in every part of the given territory. It may be much wiser not to have a campaign for selling ranges in some parts of the territory, but to have instead a campaign on some other appliance that would have a greater appeal and consequently a greater sale.

Organization Chart Serves as Company Directory

WHERE power companies serve a number of interconnected towns maintaining divisional offices and operating departments in each, it is important that employees be familiar with the relations and personnel of other divisions and the company's general or central offices. As such companies as the Ohio Public Service Company grow in size of territory and number of employees it becomes impossible for the individual to carry in his mind the plan of organization and trust to his memory for correct names and location of employees in other departments or divisions.

To make readily available for each of the employees a clear picture of the Ohio Public Service Company's organization and personnel a chart like the accompanying one but with individual names included in rectangles has been prepared and a copy furnished to every employee. It differs from the conventional type of organization chart in that in addition to laying out lines of routine or authority, it also shows names and location of individuals. It has proved much more satisfactory than a form of loose-leaf directory or reference to correspondence files and at the same time supplies the need for visualization of the company's plan of organization.



FORM OF ORGANIZATION CHART THAT SHOWS LOCATION OF MEN AS WELL AS RELATIVE RESPONSIBILITIES

In the actual chart are included the gas and railway departments, deleted here for space considerations.
In addition the individuals' names are included in the rectangles.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Ignition System for Rectifiers. — F. KLEIST. — Three-phase steel-tank-type mercury-arc rectifiers require, besides their six main anodes, three auxiliary anodes for starting the rectifier. This set of anodes, together with the main cathode, may be conceived as a complete rectifier of small output built into the main rectifier. The total of nine anodes, which have to be brought out of the cover of the vessel, electrically insulated and vacuum-tight-sealed, leave very little space for the movable ignition pin, although it is desirable to build this essential part of the rectifier as ruggedly as possible. On the latest types of rectifiers a large German firm uses a separate glass-bulb rectifier to provide permanent excitation of the main rectifier, thereby eliminating the three auxiliary anodes. The cover space gained is utilized for a very strongly built ignition pin. Closing the starting switch ignites the auxiliary rectifier by automatic tilting and the main rectifier by the action of its ignition pin. During normal operation about 250 watts direct current are available from the auxiliary glass bulb, which may be used for battery charging or relay excitation.—*Siemens Zeitschrift*, December, 1926.

Hydro-Electric Development and Steam Equipment

Unit Central Excitation in Hydro-Electric Stations.—M. DAUT CAMBY.—The exciting current necessary for synchronous generators can be produced in two main ways: Either an exciter can be provided for each generator to supply the generator with which it forms a unit, exclusively, or the whole of the exciting current for all of the generators can be generated separately and distributed to the different machines. The first case is known as unit excitation and the second as central excitation. This article discusses the extent to which the arguments against unit excitation in hydro-electric installations are justified, and whether by employing central excitation these disadvantages can be eliminated without at the same time introducing other and greater difficulties.—*A.E.G. Progress*, December, 1926.

The Sulzer 1,500-Lb. Boiler.—The primary object of the construction of the Sulzer boiler was to acquire experience in the generation and use of steam at extra high pressures. The boiler consists of two separate steam-raising units, one of which works at the full pressure of 1,565 lb. and a steam temperature of 375 deg. C. (707 deg. F.), while the other works at 200-lb. pressure with a steam temperature of 350 deg. C. or 662 deg. F. The two parts are not entirely distinct, as the low-pressure part serves as a feed-water heater for the high-pressure part. The principal object of the arrangement chosen was to study the practicability of improving an existing low-pressure boiler plant by the addition of boilers working at much higher pressures. The paper proceeds in great detail to describe and illustrate the interesting points of construction and operation of this combined low-pressure and high-pressure boiler equipment.—*Engineer* (*England*), Dec. 31, 1926.

Steam Engine Offers Interesting Possibilities.—SEARLE HENDEE.—This short article discusses the performance record of a steam engine recently developed that shows a relatively flat water curve under constant speed with a variable load. The engine, which is of extraordinarily light weight and compact size, considering its power, is of the eight-cylinder, double-action reciprocating type and, it is claimed, possesses advantages of consequence. It has only one-eighth the weight of any simple engine of equal horsepower and is one-tenth as heavy as a Corliss. The test engine, which developed 26.5 b.-hp. at 900 r.p.m., with 100 lb. of steam pressure and 0.4 cut-off, occupies 1 cu.ft. of space and weighs only 150 lb. The feature that distinguishes this engine from former ones of somewhat similar design that have proved unsuccessful is the manner in which reciprocating motion is changed to rotary. This is accomplished by means of a power ring and wabble plate that operate on a ball-bearing race, eliminating friction and applying power to the drive shaft in much the same manner as a worm gear. —*National Engineer*, February, 1927.

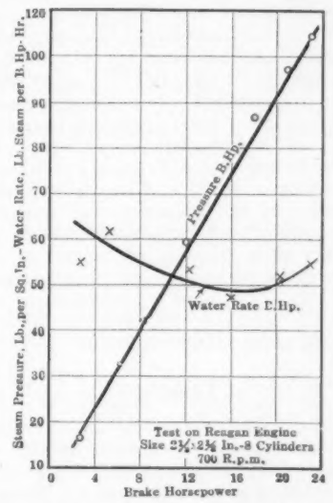


CHART OF TEST PERFORMANCE OF ENGINE AS CONDUCTED BY DETROIT UNIVERSITY

Units, Measurements and Instruments

Calculation of Condenser Bushings.—A. IMHOF.—The great advances which have been achieved in late years in the manufacture and use of bakelized paper tend to strengthen the author's belief that condenser-type bushings, in which the distribution of electric potential is carefully controlled by inner metallic layers, will eventually dominate for even the highest voltages. A simplified mathematical method is given to calculate such bushings, assuming equal axial and radial irregularities. A lead for 150,000 volts, tested with 310 kv., is taken as the basis for a practical example, in which the bakelized paper is stressed with 45 kv. per centimeter across the grain, with 2.9 kv. per centimeter along the grain in air and 6.0 kv. per centimeter along the grain under oil. The formulas give a total length of this lead of 158 cm., or 62 in. with seventeen inner layers of tinfoil.—*Bulletin de l'Association Suisse des Electriciens*, December, 1926.

Critical Survey of Recent Advances in the Study of Diamagnetism.—E. S. BIELER.—After a thorough search of literature available on the subject, the writer of this article came to the conclusion that there was room for a fuller account in English of diamagnetism, bringing together not only the fundamental theoretical work of Langevin and the large amount of experimental work that has been carried out before and since, but trying at the same time to connect the occurrence of diametric properties in elements and compounds with the work of Bohr and his followers on the periodic system of the elements. As expressed by the author, his present survey does not aim at completeness. He has tried only to bring together significant facts and to examine them. In doing so he has tried to lay emphasis on the points which seem to him unsatisfactory in the present theory, and on the directions in which further experimental work on this subject would seem to be indicated. —*Journal of Franklin Institute*, February, 1927.

Transmission, Substations and Distribution

Grounding 4,000-Volt Distribution.—W. B. BUCHANAN.—Some time ago the laboratories of the Hydro-Electric Power Commission of Ontario were requested to take part in a study of conditions which existed on a rural distribution circuit and services fed therefrom, and the results obtained were of such striking character that it was felt they would serve as a basis for discussion of the general problem of grounding of distribution circuits. Consequently, the author has taken up here a general discussion and explanation of some of the features of the work which has been done.—*Electrical News* (*Canada*), Feb. 15, 1927.

High-Voltage Switchgear.—E. KÖNIG. —The problems of proper insulation for switchgear operating at 110 kv. to 220 kv. do not seem to be so thoroughly understood as is warranted to insure the full reliability of such apparatus. Of the three main classes of dielectrics, the gas type seems the most desirable one. Carbon dioxide, for example, when compressed to only 15 atmospheres, has a puncture voltage of 280 kv. per centimeter. Practical application of gaseous insulators has been hitherto restricted to laboratory use. Among liquid dielectric materials oils lead. They are homogeneous and isotropic, but not free from losses. Porce-

lain and bakelized paper are the most important solid insulating materials. Porcelain is heavy, bulky and inaccurate as to size, but is weatherproof. Hard paper is highly hygroscopic and has good dielectric qualities only across its paper layers. The last-named property must be carefully taken care of in the design of bushings and switchgear elements. In the second part of the paper the author discusses overvoltage protectors, suggests suitable test voltages and discusses the advantage of phase separation.—*Elektrotechnik und Maschinenbau*, Dec. 19, 1926.

Illumination

Radiometric Measurements on the Carbon Arc and Other Light Sources Used in Phototherapy.—W. W. COBLENTZ, M. J. DORCAS and C. W. HUGHES.—In this paper data are given on the distribution of energy in the spectrum of the carbon arc under various conditions of operation. The problem was attacked by two methods: (1) The energy distribution in the visible and in the ultra-violet spectrum of the radiation emitted from the central line through the arc and incandescent electrodes was obtained by means of a quartz spectroradiometer, and (2) by means of transmission screens the spectral radiation components of the whole arc, including the surrounding reflector, were obtained in seven steps throughout the complete spectrum. Data are presented on the variation in the radiation from the carbon arc, using different sizes and kinds of carbon electrodes, different kinds of cores, and the effect of alternating current and direct current. Comparative data are given on the sun, the gas-filled tungsten lamp, the quartz-mercury arc and the arc between metal rods of tungsten and of nickel. Results obtained show that while the carbon arc approaches nearest the sun in spectral energy distribution, it is important to use the proper size of electrode and current in order to obtain the most efficient operation of the lamp. The high-intensity arc was studied, and while it was found useful for large installations, the same relative proportions of ultra-violet to the total emitted can be obtained from a small unit utilizing from 20 amp. to 30 amp. as is obtained from the larger unit taking 90 amp. to 125 amp.—*Scientific Paper No. 539, Bureau of Standards.*

Motors and Control

Motor Drive for Pole-Type Disconnecting Switches.—G. HEUSSER.—The sectionalizing of the 15-kv. feeder lines of the Swiss Federal Railway system is accomplished with pole-type disconnecting switches operated by rods from the base of the pole. At some points it was desired to actuate such switches by remote control, and for this purpose a motor drive was developed. A small 113-watt series-wound direct-current motor with vertical shaft was placed in a narrow frame, driving over a 3,000-to-115-r.p.m. reduction gearing and a slip clutch a stationary nut into which is threaded the lower end of the switch-operating rod. The entire driving unit is very compact, measuring only 9 in. in diameter and 39 in. in length. The opening or closing cycle requires two and one-half seconds. Only three wires are needed for the operation and the position signaling system.—*Bulletin de l'Association Suisse des Electriciens*, December, 1926.

Traction-Type Electric Elevators.—F. MORTZSH.—European elevator designers are gradually introducing the traction type of drive, which has, even for limited height of travel, decided advantages over the drum type formerly used exclusively. Aside from the gain because of less floor space and increased safety, the main advantage of the traction type is that the same driving set is suitable for any height, which gives the manufacturer an excellent basis for standardization. The speed regulation and the braking are relatively simple problems for direct-current drive. For three-phase motors two methods are considered standard by European designers. The driving motor gives two main speeds by changing the number of active poles, or two motors, one of low and one of high speed, are mounted side by side on the main driving shaft. The latter method is frequently used. The low-speed motor is driven over-synchronously while braking. As an example, the elevator equipment in a 100-ft. observation tower is described. The traction sheave is driven by a worm gearing the worm shaft of which carries a 9-kw., 565 r.p.m. motor and a 20-kw., 1,465-r.p.m., three-phase motor. The cabin has a capacity of ten passengers, is hung on four cables of ½-in. diameter each and travels at a speed of 5 ft. per second. A diagram of the control system and a detailed description of regulating and braking methods is given.—*Elektrotechnik und Maschinenbau*, Dec. 26, 1926.

Traction

Wear of Contactors.—H. BALKE.—Excessive wear was noticed on the contactors of single-phase locomotives when braking on 16⅔ cycles, 120 volts, with 1,200 amp. Oscillographic investigation proved the abnormal wear to be due to rebounding action of the closing contacts. Experimental studies, in which closing speed and contact pressure were modified and properly correlated, resulted in greatly improved performance. A pair of contacts showed very slight wear after 15,000 operations, and the following conclusions were reached: The mechanical and electrical wear of high-speed alternating-current contactors may be reduced to a minimum if (a) the contacts have chiefly a wiping action against each other, and (b) if the contact pressure is in a certain ratio to the contact speed; that is, if the pressure is increased with increasing speed.—*Elektrotechnische Zeitschrift*, Dec. 30, 1926.

Heat Applications and Material Handling

Arc Welding Aided by Hydrogen.—P. L. ROBERTS.—Two new adaptations of the electric arc as employed for welding metals have been developed as a result of investigations in pure science. They attain the same end by the use of different means and are equally important in that they produce welds of extremely good mechanical properties. A further common advantage is the high speed of welding which can be attained. The first of these processes is known as "atomic-hydrogen arc welding" and owes its origin to the research work of R. A. Weiman and Irving Langmuir. The second process also involves the use of the well-known metallic arc, but in an atmosphere of hydrogen, and was investigated by P. Alexander, partly under the direction of Dr. Elihu Thomson. The author proceeds to give details of the apparatus used in both systems of welding.—*Electrical Review (England)*, Jan. 7, 1927.

Telegraphy, Telephony, Radio and Signals

Faults on Distribution Systems Located by Radio.—C. P. EDWARDS.—This article covers a general discussion of the use by public utilities of portable radio receivers in automobiles to track down faults on distribution lines. There are many faults on distribution systems, such as contact from a power wire to some ungrounded metal, which may be located, according to the author, more readily by means of a radio receiver than by any other method at present in use. Faults of this nature frequently cause considerable hazard to both linemen and the general public. The author mentions a group of tests using radio equipment and explains that while none of these tests give conclusive results regarding the system containing the fault or the location of the fault, they do give clues to aid in such investigations.—*Electrical News (Canada)*, Feb. 15, 1927.

Regenerative Telegraph Repeaters.—H. H. HARRISON.—This paper opens with a review of the method employed among telegraph administrations having to operate long and difficult circuits or mixed circuits, circuits in which submarine cables work into land lines and vice versa. Some of the disadvantages of the ordinary type of telegraph receiver are considered. Following a discussion of the requirements for securing maximum traffic capacity of long lines and an analysis of the operation of the ordinary repeater, the author takes up the development of the Baudot method. The article is accompanied by several detailed graphs which are employed in explaining the complicated sequence of operation of the repeaters.—*Electrician (England)*, Jan. 7, 1927.

Dynamical Study of the Vowel Sounds.—I. B. CRANDALL.—Comparative studies based on oscillographic records of the principal characteristics of vowel, semi-vowel and consonant sounds have contributed much to an understanding of the mechanism of speech. The present paper is concerned with the mechanism of a double resonator system and a mathematical treatment thereof. Based on the volume, shape and coupling of the resonating chambers, some models of cardboard, tube and plasticene were made, and with them experimental tests in the production of vowels were carried out.—*Bell System Technical Journal*, January, 1927.

News of the Industry

Boulder Dam Bill Advocates Fight Hard

But Filibuster by Its Opponents Seems Likely to Defeat Measure—Tardy Agitation Over Muscle Shoals Also Barren of Results—Sheffield Plant in Danger?

By Paul Wooton
Washington Correspondent Electrical World

THOUGH the Boulder Canyon Dam bill reached the high mark of its protracted legislative course when it became the unfinished business of the Senate on Feb. 19, there is no likelihood of definite action upon it, and the bill is expected to die with the Congress on March 4. As this is written a desperate effort is being made by the proponents of the bill, led by Senator Johnson of California, to force it to a vote. The Senate was held in session all night on Feb. 22-23 while Senators Ashurst and Cameron of Arizona relieved each other in discussing the bill, when time was not consumed in efforts to obtain a quorum. A previous agreement forced suspension of the fight on Wednesday afternoon, with the virtual certainty of its resumption on Thursday.

Senator Johnson of California in his appeals for action on the measure placed his principal emphasis on the need for safeguarding the Imperial Valley from floods. Senator Ashurst of Arizona told the Senate that the advocates of the Swing-Johnson bill could have had flood protection long ago and the all-American canal in addition, had they been willing to forego the effort to acquire "Arizona's potential hydro-electric energy." Senator King of Utah expressed the opinion that the federal government has no right to build a dam in any stream without the consent of the state. "The primary object of the bill," he continued, "is not the protection of Imperial Valley. The driving force behind it is to furnish water and power to the municipalities of southern California."

Senator Johnson proposed an amendment to his bill eliminating the authorization to the Secretary of the Treasury to issue bonds for the construction work. This was to meet the objection raised on the ground that a revenue-raising bill may not originate in the Senate. Senator Johnson also submitted an amendment providing for the recognition of the Colorado River compact if signed by five states.

Belated Excitement Over Muscle Shoals Situation

With adjournment only a week away, Congress suddenly has become excited about Muscle Shoals. As this is written, it seems unlikely that agreement can be secured on any legislation. Had the same amount of interest been shown earlier in the session, it might have been possible to dispose of the matter. Those who are opposed to the government in business are much pleased with the way in which Congress is handling Muscle Shoals legislation. It provides the prize exhibit, they contend, to display unmistakably how Congress functions on a business problem.

Discussion of the situation in the Senate on Feb. 23 revealed clearly that the members of that body are hopelessly divided on the question. Senator Underwood declared there should be no surplus of power for distribution. He urged that an offer be sought under which all of the power would be used in the fixation of nitrogen. An agreement was reached for a further two hours' debate on Friday.

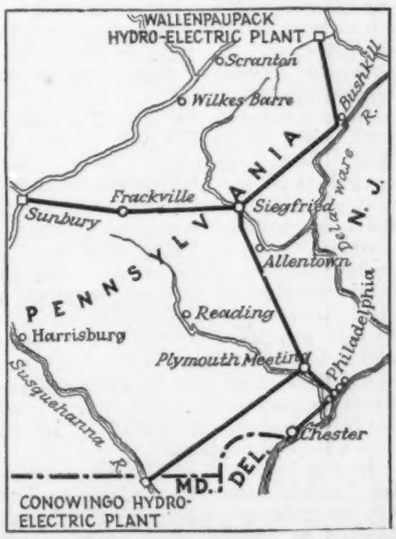
To add to the confusion of the situation, plans are being made for the reception of the Governor of Alabama and a recently appointed Alabama Muscle Shoals Commission. These Alabama officials will try to convince the federal authorities that they are infringing on the right of a sovereign state in attempting to make any commercial disposition of the power which does not make it subject to the regulatory powers of the state. The Vice-president has already laid before the Senate a communication of that tenor from the Governor of Alabama.

A proposal to increase the capacity of the Sheffield steam plant has brought out the fact that the present steam plant is endangered by an earth movement. The plant is between two hills from which the overburden seems to be slipping slowly into the gulch where the plant is built. Operation of the steam plant also has developed that it is poorly located in regard to coal supply. It is believed that any additional auxiliary power will be arranged for at a better-situated point.

Wide Interconnection for Pennsylvania

Agreement to Tie in Lines of Philadelphia Electric Company and Those of Pennsylvania Power & Light Will Bring "Largest Pool of Power"

AGREEMENT between the Philadelphia Electric Company and the Pennsylvania Power & Light Company to interconnect the existing 220-kv. transmission system of the latter with the 220-kv. line to be built from the Conowingo plant of the former, now under construction, was made public on Monday of this week by President Walter H. Johnson of the Philadelphia Electric. The connecting link will be a 50-mile line of the same voltage from Plymouth Meeting, near Philadelphia, to the substation at Siegfried, near Allentown, which is the terminus of the Pennsylvania Power & Light's line from its hydro-electric plant at Lake Wallenpaupack, in the northeastern end of the state. The contemplated link will thus tie together the Wallenpaupack and Conowingo plants, and the territory served will extend from the New York State line south to Maryland and west to the Pennsylvania's substation at Frackville and coming steam station near Sunbury, Pa., in coal-mining regions. The entire length of the two companies' interconnected line will be 200 miles. Great savings in operating expenses by means of this interconnection are predicted.



Pennsylvania's Coming 220-Kv. Interconnection

"Construction work on the line will begin immediately," President Johnson said, "with the view of making possible initial operation and interchange of electrical energy on or about Jan. 1, 1928. This interconnection will provide a common pool of power of approximately 2,000,000 hp. It is the largest pool of power at present in sight. The two interconnected systems are of such size and have such load-demand characteristics as to permit the interchange of tremendous blocks of energy, attended by improvements in reliability of service, economies of operation and savings in investment, all of which, ultimately, will accrue to the benefit of the public served.

"The maximum benefits to be derived

from any interconnection program are possible only when maximum power demands do not coincide," Mr. Johnson's announcement went on. "Our studies show that the saving in capacity is on the order of 200,000 hp. for the combined companies and represents a saving investment of many millions.

"A master system dispatcher will be within instant touch of every part of the combined system, either by direct wire or by especially designed radio, receiving information of present and expected load conditions from all points, planning the most economical method of supplying the load and finally directing how each particular section of the load should be allocated between the various generating plants."

A future probability hinted at by President Johnson is the building of a 220-kv. line from Siegfried through New Jersey, permitting the Public Service Corporation of that state and the metropolitan district in New York to interchange energy with the Pennsylvania systems.

Radio Control Bill Passed

Both Houses Adopt Conference Report, Which Vests Authority in Board and Commerce Secretary

BOTH houses of Congress have adopted the conference bill on radio transmission, which the President has already signed. This bill is a compromise between the original Dill and White bills. It is expected to remedy the confused conditions now complicating the broadcasting industry and is the outcome of a widespread popular demand that some action be taken.

The new law will be administered for one year by a presidential commission of five, with the Secretary of Commerce acting in an administrative capacity, and after that by the Secretary, except as to revocation of licenses and controversial matters, which would be referred to a permanent commission. The commission first formed is empowered to classify broadcasting stations, prescribe the nature of their service, assign wave bands, power and time, determine location, regulate the character of apparatus used and control interference and chain broadcasting.

All existing broadcasting licenses are to be renewed after the passage of the act, although 60 days is granted in which operators may continue without objection. Anti-monopolistic provisions insure the refusal of licenses to any person or corporation convicted in a federal court of unlawfully monopolizing radio communication or trade in radio apparatus in interstate or foreign commerce. The bill also forbids the granting or transferring of a license to any alien, any foreign government or any corporation in which an alien is an officer or in which a fifth of the stock is held by aliens. Penalties attached to the bill provide a fine of $500 for violating the law or regulations issued under it and a fine of $5,000 or five years' imprisonment, or both, for the making of a false oath. Another section declares that equal courtesies are required in political broadcasting and that the sources of paid broadcasting must be announced.

Electric Generation in Many Phases

Papers at Second Midwest Power Conference Cover a Wide Range and Show that Need for Central-Station Energy Grows Continuously in Industries of Various Kinds

BOTH actual and hypothetical instances of the use of power in cement mills, paper mills, packing plants, corn-products refining works and steel mills received attention in great number at the meeting in Chicago of the Midwest Power Conference, the opening session of which was reported last week. Recent developments in coal burning, industrial power-plant development, the fuel-oil situation and the possible economy of construction and operation of gas and electric utilities in combination were the subjects of papers. The sessions were closed by an address by Paul S. Clapp, managing director of the National Electric Light Association, who spoke on the electrical development of the United States, citing the many ways in which the central-station industry has contributed to the material and social progress of the country.

The conclusion that the cement mill is lost to the central station as a prospective customer was drawn from a paper by J. H. Lendi, chief electrical engineer of the Universal Portland Cement Company, who said that purchased power must be sold at materially less than 0.75 cent per kilowatt-hour to compete with the isolated plant utilizing waste heat from kilns. Campbell Osborn of the Marland Oil Company held that there is no immediate cause for alarm about the diminution of oil supply. Notable economies of industrial-plant operation were instanced by S. G. Neiler of Neiler, Rich & Company, who pleaded for some means of reaching agreement in rate of depreciation and obsolescence in comparisons of isolated plants and purchased power. C. H. Kane of Swift & Company, Chicago, was optimistic about the use of power in the packing industry. In spite of the very large utilization of process steam and the common idea that such use is always a justification of the isolated plant, central-station service is almost a necessity in packing-plant operation, he declared, going on to give definite information on the co-ordination of packing-plant load with the operating conditions of the central station.

In a paper on the use of power in steel mills, Wilfred Sykes of the Inland Steel Company, Chicago, contended that the development of the central station for the sale of power by the large utility companies has had a material influence upon the type of power used in many plants. Of the total number of motors installed in steel plants, approximately 30 per cent, he said, are driven by purchased power, and it has been demonstrated in many cases that steel plants without blast furnaces can purchase power to advantage, instead of installing an individual power plant.

In a paper on "Location of and Coal for Central Power Plants," S. A. Taylor, consulting engineer, Pittsburgh, pointed to low-cost fuel supply, sufficient water and nearness to electrical load center as the main elements to be considered in selecting a power-plant site. None the less, he admitted, appreciable compromises must be made regarding one or more of these elements and density of electrical load is the most important. Mr. Taylor dealt with the relative virtues of deep-mined and strip coal, ascribing definite advantages to the latter.

A notable paper on "Recent Developments in Coal Burning" was presented by F. S. Collings of Sargent & Lundy. In the Middle West, he said, there has been a recent tendency to recede from the high-combustion rate possible under forced draft on account of the additional cost of maintenance and outages due to use of low-grade fuels. The development of unit pulverizer systems, with a number of references to the Ashley Street station of the Union Electric Light & Power Company of St. Louis, was treated at some length.

Insull Speaks at Banquet

At the banquet of the conference on Thursday Samuel Insull was the speaker. Mr. Insull devoted most of his address to reminiscences of his 48 years in the electrical industry. Coming to the present day, he said: "The so-called superpower development of the last few years is not an accident. It is the economic result of the cheapening of the cost of production and the necessity, in order to get the lowest possible cost of that production, to mass into very large quantities energy that can be most economically produced with the largest possible prime movers." Alluding to the disposition of some professional reformers to force government into industry affairs, Mr. Insull said: "I think no greater blow could be aimed at the general development of the industry in these United States than anything which would attack the credit of the great power companies of the country. That is one subject our friends who sit in legislative councils need to consider well and fully before they attack an industry which bears so important a relation to the whole industrial development of the country."

California Power-Plant Men Welcome Storm

So far from being depressed by the recent violent storm in California, with its incidental damage to transmission and distribution lines, operators of power plants in that state declare that the damage from the storm is insignificant when weighed against the benefit. After seven years' drought the rains are hailed with joy. Ample water supply is now assured to power and irrigation districts. The water level of the wells in the San Joaquin Valley is rising for the first time in ten years. The rainfall has, light and power men say, assured exceptional prosperity this season.

Federal Trade Commission Heard From

First Report to Senate on Investigation in Electrical Manufacturing and Power Field—No Censure for General Electric Company—"Pyramiding" Condemned

A REPORT was submitted to the United States Senate on Feb. 23 by the Federal Trade Commission in partial response to the Senate resolution of Feb. 9, 1925, calling upon the commission to investigate the organization, control and ownership of commercial electric power companies. The commission has also in preparation a comprehensive discussion of the supply of electric power machinery and equipment, particularly with respect to the General Electric Company, and of competitive conditions in the entire power field.

At the time this resolution was approved it was charged in the Senate that the General Electric Company had acquired and was exercising a very extensive control over the electric power industry, either directly or indirectly through stockholders or interlocking directors or otherwise. Consequently, the commission says, a comprehensive inquiry into the entire electric power industry was necessary.

The report first summarizes the extent of the control exercised over the industry by the General Electric Company before it divested itself of the Electric Bond & Share Company in December, 1924, conceding the apparent genuineness of this divorce; then inquires into the rate of profit on the book value of investment, which it puts at an average of nearly 8 per cent; then scrutinizes the record for large stockholders in common with other companies, the result being negative. Next the report looks into interlocking directorships, finding occasional relationships but of a kind that implies no especial influence over management. It takes up holding-company management as instanced by the Electric Bond & Share Company, states the arguments for it and seems to find them conclusive. Finally, the Federal Trade Commission deals with holding-company "pyramiding," giving as an example a case where a million-dollar investment in an "apex" company gave full control over several hundred millions of investment. Here the commission, it may be inferred, finds a real abuse—one, it says, which calls for federal legislation to correct it.

The report in full follows:

Extent of Industry Control

"The extent of the control of the industry by the General Electric Company is stated in this report for December, 1924, at which time it decided to divest itself of its principal instrumentality for controlling operating electric power companies, the Electric Bond & Share Company. The latter company held stock in five large holding companies which controlled completely a large number of operating companies, each of which was under the financial or operating supervision of the Electric Bond & Share Company. The proportions of voting stock so held on April 30, 1925, were: American Gas & Electric Company, 6.68 per cent; American Power & Light Company, 22.59 per cent; Electric Power & Light Corporation, 16.24 per cent; Lehigh Power Securities Corporation, 12.68 per cent, and National Power & Light Company, 11.95 per cent. The Electric Bond & Share Company also held about 15 per cent of the voting stock of the Carolina Power & Light Company, the United Gas & Electric Corporation and the Southeastern Power & Light Company, the first company being likewise under its supervision and management. The Southeastern Power & Light group included the Alabama Power Company, one of the bidders for the Muscle Shoals plant, a matter of some interest with respect to this inquiry. While there were some other considerable holdings of the Electric Bond & Share Company, they were much less significant than those mentioned.

"In addition to the apparent control of various companies through the Electric Bond & Share Company, the General Electric Company was directly or indirectly a stockholder in a few other companies, but only one of them was of considerable size.

General Electric and Bond & Share

"As a result of the decision of the General Electric Company of Dec. 30, 1924, to divorce itself from the Electric Bond & Share Company, a new corporation was organized to which its stock in the Electric Bond & Share Company was given in exchange for the stock of the new company, said stock being then distributed proportionally among all the stockholders of the General Electric Company. In this way the General Electric Company divested itself of the great bulk of its financial interests in electric power companies. But as the stockholders of the General Electric Company were originally identical with those of the new company which controlled the old Electric Bond & Share Company, the question remained how far this formal divorce constituted a real separation. An examination of the lists of stockholders as of September and October, 1926, showed that there were no large or dominating stockholders in either company, and that the original identity of holdings had been reduced by 21 per cent in about 21 months. The present boards of directors of the two companies contain no common directors, and the board of the Electric Bond & Share Company appears to be in a position to manage its affairs independently.

"Taking the situation, however, as it was before Dec. 30, 1924, a careful computation was made of the extent of that part of the electric power industry in which the General Electric interests referred to above owned a significant interest. Reports regarding the principal statistical facts of interest were obtained from operating companies producing in 1924 over 95 per cent of the electrical energy generated in the United States. Of this total the General Electric interests had 12.5 per cent of the installed capacity, 11.8 per cent of the electrical energy generated and 9.6 per cent of the number of customers. While no other single interest equaled these percentages of the total industry, two of the largest groups (North American and Insull) were not very far behind, and the various large holding companies taken together had several times the importance of the total General Electric interests. Moreover, the isolated companies in the aggregate were almost as large as the General Electric group. Most of the General Electric interest in the electric power industry was, as already indicated, tied up in the Electric Bond & Share Company, and if that may now be regarded as separated, the remaining portion is much smaller than many large holding company groups.

Average Rate of Earnings

"From the reports made by the operating companies referred to it is possible to show for the great bulk of the industry the average rate of net earnings in 1924 on total book investment, no attempt being made to determine whether this book value of investment conformed to the fair value thereof. This rate of profit averaged nearly 8 per cent. The variation between the different large groups was not especially significant, but the average rate for the General Electric interests was a little less than the average for all of them. The income-tax statistics for the years 1918 to 1924 show that there has been a very marked increase in the taxable income of the electric power corporations, corresponding with the rapid development of the industry, while for corporations generally the total taxable income has decreased. The remarkable activity during the past few years in the organization of electric power operating companies into various power groups appears to have been induced by the opportunity to exploit their earnings, as well as for the purpose of increasing their efficiency. Encouragement is afforded to pyramiding activities through the possible gains of such speculative investment in a rapidly developing industry, even though the rates are fixed by public authority. Any reduction of rates or increase in operating costs would be much more marked in effect on the earnings of these pyramided companies than on the underlying operating companies.

Stockholders in Common—Interlocking Directorates

"An inquiry was also made into any connections between the General Electric Company and other companies through stockholders in common, on the basis of reports made by almost all of the important electric power holding or operating companies, giving the names of the 25 largest stockholders in each case. So far as this test is concerned the results were entirely negative and showed no significant indirect connections of this sort.

"Likewise a test was made of the interlocking directorships. Of course between the General Electric Company, the Electric Bond & Share Company, the several holding companies and the nearly two hundred operating companies of these groups there were very numerous interlocking directorships, this being an essential feature of the control and management exercised. This control was generally disclosed, moreover, in the financial manuals. But, besides these more or less natural interlocking directorships, there were a few others which connected the principal General Electric interests with power groups which are generally assumed to be independent of it. Thus one director of the General Electric Company (who recently died) was also a director of the North American Company, but that he had any special influence in the management of the North American Company is not apparent. Another General Electric director was also on the board of the leading Insull company, but there is no apparent indication that this involved the exercise of much influence in its affairs. In both of these cases, in number and influence the other directors appear to have been much more important. Among all the other operating or holding companies, seven directors in the General Electric Company or the Electric Bond & Share Company held ten directorships. Of the six more important companies thus connected none appears to be involved with the General Electric interests in any other way, except a 6 per cent voting stock interest in one of them (Montana Power Company). Among the hundreds of directors of considerably more than two hundred companies in the entire General Electric group, there were found 49 additional directors who also held directorships in companies not belonging to that group. In a few instances these directorships were in important companies such as the United Light & Power Company and the Commonwealth Power Corporation, but there was no indication of a connection involving definite affiliation of interests. The minutes of several of the chief electric power holding companies, as well as of the General Electric Company, were examined, and especial attention was paid to the question of evidence regarding the significance of such interlocking. But neither from this source nor from other inquiry in the industry did it appear that such occasional relationships were indications of especial influence over the management.

Holding-Company Control

"Particular inquiry is directed by the Senate resolution into the manner in which the General Electric Company acquired and maintained control over the electric power industry and whether it was accomplished in violation of law. This involved an extensive study of the history of this development. Such control as was established was based chiefly, as already indicated, on the activities of the Electric Bond & Share Company. But the Electric Bond & Share Company was itself the outgrowth of previous experience of the General Electric Company and its predecessors in the manufacture of electrical machinery and equipment. In the earlier days of this industry it was very difficult to build up the electric manufacturing industry, because the customers for its products were themselves small and financially weak. Much of the electrical equipment was sold not for cash, but part cash and part stock and bonds of the new power enterprises. At first the necessity of realizing cash for such stock and bonds, and later the advantage of pro-

moting a better engineering and operating management in order to increase sales of electrical goods, drew the larger electric manufacturers into the electric power business. The Electric Bond & Share Company became the organization by which the financing for such enterprises was aided, and afterward expert engineering and operating services were rendered for compensation. Especially for numerous plants in small adjacent localities, a physical connection and the installation of improved equipment under expert advice increased the efficiency of operation and the stability of power demand, as well as the salability of the securities issued. In the larger groupings a diversity of demand was sought by including operations in widely separated localities with different industries, or with the differences of city, small-town and agricultural use of electricity. This tended to minimize the risks of unprofitable operation.

"The principal financial problem was that of marketing securities, and it was easier to dispose of the bonds of operating companies if the stock and management were taken by experienced people with strong financial backing. Generally a holding company was organized and on the basis of the shares of the operating companies, which constituted their assets, they sold their own bonds and preferred and common stocks to various classes of investors. Several elaborate groups, already referred to, were thus built up in which the Electric Bond & Share Company retained only a limited amount of voting stock after the enterprises were well established. Through the holding company of each group, however, service contracts were procured with respect to each operating company which insured, generally, financial, engineering and operating supervision and management by the Electric Bond & Share Company. While these contracts were not apparently onerous and could be terminated by either party upon short notice, the relationships and conditions were such that no question of their premanency, apparently, disturbed the plans of the supervising organization.

"But while the General Electric Company, through the Electric Bond & Share Company, was thus building up an extensive organization of electric power companies, the field was so large that there were abundant opportunities for any other group with sufficient financial backing and expert knowledge to do likewise. Indeed, the firm of Stone & Webster in many important respects was the pioneer in this activity, rather than the Electric Bond & Share Company. At any rate, there has developed in fact, as already indicated, a number of other important electric power groups which in 1924 far exceeded in the aggregate the General Electric group. Among these may be mentioned the 'Insull interests,' the North American Company, the Stone & Webster group, already referred to, the Standard Gas & Electric (Byllesby) group, the Cities Service (Doherty) group, the Commonwealth Power group, etc.

Evils of Pyramiding

"One of the problems of public interest concerning some of the large electric power groups is the extreme degree to which 'pyramiding' has been carried in superposing a series of holding companies over the underlying operating companies, so that in one instance less than a million-dollar investment in the majority of the voting stock of the apex holding company gave in 1925 full control of the entire organization of the group, having scores of underlying companies and several hundred millions of dollars of investment. Such pyramiding not only affects the financial stability of the electric power industry, but also has a potential relation to the more general question of an undue concentration of control in the electric power industry. As the extensive grouping of electric power companies often brings their business into the field of interstate commerce, it presents a problem that calls for legislative consideration by Congress."

In the Legislative Mill

Political Activities on the Pacific Coast—Cann Bill Beaten in Indiana —Minnesota Hydro-Electric Bill

BY INDEFINITELY postponing a resolution authorizing the state to enter into agreements with other states for the interchange and sale of hydro-electric energy the Oregon Legislature soon before adjournment brought to an abrupt end all political efforts to revive the question of public ownership of utilities. The Senate passed a bill for an amendment to the constitution providing for the appointment of members of the Public Service Commission by the Governor in place of their election by the voters. This bill may go to referendum.

At an open hearing in the Senate Chamber in Olympia, Wash., friends of the Metcalf power bill, which would permit cities to sell electrical energy outside their limits, declared that the measure would only give "justice to neighbors" of cities owning electric plants. E. K. Murray, city attorney of Tacoma, asserted that the measure "eliminated any possiblity of abuse" in regard to the sale of power and declared that farming communities near the transmission lines from Tacoma's Cushman plant "ought, in justice, to be allowed to buy power." A Seattle councilman said that rate cuts were always made by municipal plants and would force the private companies to reduce rates.

The State of California would have control over surplus waters and rivers within its borders under the terms of a proposed constitutional amendment which has been recommended by a subcommittee of the water conservation committee. The amendment is in direct opposition to the Supreme Court's decision in the Herminghaus case, giving owners of riparian water rights exclusive use of water flowing by their land. The proposal of the committee is said to have the approval of Governor Young.

The Cann bill to abolish the Public Service Commission of Indiana has been overwhelmingly defeated in the Senate. The Moorehead bill calling for the election of commissioners will be withdrawn and its author with two others will draft a substitute measure in accordance with instructions of the majority senators. The new measure will be designed to bring utility holding companies under jurisdiction of the commission, and probably contain a provision by which the Senate would confirm executive appointments of commissioners. The cities and towns committee of the House has reported a bill which places municipal utilities under jurisdiction of the local government instead of the commission and also permits cities and towns to establish or buy utilities. Senator Harrison of Indianapolis will introduce a joint resolution requesting the Indiana delegation in Congress to prepare and support legislation which would deprive the United States courts of jurisdiction in all suits that may be filed by public utility corporations seeking relief from orders of the public service commission unless the utilities first have exhausted all legal remedies given by state courts. Congress has had similar legislation before it at various times, but thus far it has not succeeded.

Legislative measures designed to remove or curtail jurisdiction now exercised by the Public Service Commission over public utilities in the cities of Kansas have been introduced in both branches of the Legislature. The Jones bill proposes the transfer to municipalities of all regulatory authority over public service companies. Another bill introduced by the same member would permit competition as opposed to regulated monopoly.

Public utility holding companies may find their financing in Kansas circumscribed by state authority if the State Legislature acts favorably upon a proposal favored by the Public Service Commission and designed to empower the commission or some other state department to pass upon the maximum amount of stock that holding companies may issue in Kansas. Issuance would be allowed only against the actual value of their property. At the last biennial session of the Kansas Legislature a measure introduced to prevent a holding company from owning more than 10 per cent of the stock of any utility company operating in the state was defeated in committee.

Preservation of state water-power sites and supervision of all future industries of this kind are placed under the Minnesota Railroad and Warehouse Commission in a House bill introduced by Representative Starkey. The bill would not affect any power-dam sites now developed, but would place under state regulation all such activities in the future. Disposal of state-owned dam sites would be permitted under lease for 99 years or less.

A bill has been introduced in the North Dakota House by Representative Wilson which, if enacted into law, will give authority to village or city boards to sell municipal electric light plants and transmission systems when such sale is approved unanimously by the board. If opposed by a single member of the board, a special election would be necessary. If prior to the board's action 30 per cent of the voters protest, a special election must be called.

Two bills introduced in the Oklahoma Legislature relate to cities acquiring public utilities. One of these eliminates from the present law the section which requires municipalities voting bonds for public improvements to fix rates sufficiently high to pay the interest on the bonds and not less than 3 per cent per annum on the principal in excess of the expenses of maintenance and operation. The other provides that every city and town may acquire within or without its corporate limits real estate for sites and rights-of-way for public utilities and conduct and own public utilities and shall also have the right of eminent domain; but to issue bonds for such purposes a public vote must be held and approval be given by 60 per cent of those voting. A third bill prohibits the governing body of any municipality from selling or leasing any municipal utility plant when the actual cash value of the same exceeds $10,000 in a city of the first class or $5,000 in a village or town, except when such transfer is authorized by a majority of the voters.

The Oklahoma House bill which would have forced corporations to pay state income taxes has been defeated by a vote of 55 to 50.

Co-operation the Keynote

Its Importance Stressed at New Mexico Convention, with Special Reference to Educational Institutions

WHEN the three-day session of the New Mexico Utilities Association closed on Wednesday, Feb. 16, at the Franciscan Hotel, Albuquerque, the most successful annual convention in the twelve years of the association's existence came to an end. The outstanding feature of the program was the address of Dr. James F. Zimmerman, acting president of the University of New Mexico, who stressed the importance of closer co-operation between educational institutions and public utilities and recommended state regulation of utilities in preference to municipal regulation from the standpoint of standardization. George E. Lewis, director of the Rocky Mountain Committee on Public Utility Information, spoke on the importance of newspaper publicity along educational lines and the necessity of co-operation with public schools and higher institutions of learning.

J. J. Cooper, Mountain Electric Company, Denver, took as his topic the importance of the jobbers' position in the industry. Miss Inez Thompson, Public Service Company of Colorado, Denver, dealt with women's activities and the relation between employer and employee. Arthur Prager, Albuquerque Gas & Electric Company, explained the use of the courtesy card as an aid in promoting better public relations. The development and progress of rural electric service in the past twenty years were discussed at considerable length by J. A. Clay of the Western Colorado Power Company, Durango, Col. Other items of the program were the presidential address by Frank Schram, Southwestern Public Service Company, Roswell, and an address by George Bakewell, Jr., executive manager Electrical League of Colorado.

The morning of the second day was devoted entirely to the Commercial Section and the Public Relations Section. The commercial meeting was presided over by Fred Norcross, Home Gas & Electric Company, Greeley, Col., and the public relations session by Frank R. Jamison, Public Service Company of Colorado. The commercial men discussed at length the recent developments in electrical refrigeration and its relationship to the manufacture of ice. The public relations meeting brought forth more general discussion than any other part of the program.

Wednesday morning was devoted to the Engineering Section, the meeting being presided over by P. C. Schools, Western Colorado Power Company. A paper on the importance of power surveys by H. H. Kerr, Public Service Company of Colorado, was the chief item, and an appeal was made to every one connected with the industry to get behind the power survey of the Rocky Mountain district.

A plan to concentrate the activities of the Rocky Mountain district into one association and eliminate duplication of effort was proposed by O. A. Weller, secretary of the Rocky Mountain Division, N.E.L.A., and recommended by A. C. Cornell, Graybar Electric Company, Denver.

The entertainment features of the convention were a dance at Selva's Pavilion in the Manzano Mountains, varied with boxing contests and Indian dances; the annual banquet on Tuesday evening, and a trip to the Isleta Indian Reservation, where more Indian dances and races were witnessed.

Officers elected were: President, J. B. Ledlie, Mesilla Valley Electric Company, Las Cruces; first vice-president, C. C. Ogle, Agua Pura Company, Las Vegas; second vice-president, W. W. Nielson, New Mexico Power Company, Santa Fe; secretary-treasurer, B. L. Wiles, Albuquerque Gas & Electric Company, (re-elected).

Maine Power Interests Urge Surplus Energy Export

Declaring that $500,000 worth of surplus hydro-electric energy will run to waste in Maine during 1927 because of the non-exportation law, President Walter S. Wyman of the Central Maine Power Company, Augusta, has issued a statement to the newspapers asking that the passage of the Smith bill (see ELECTRICAL WORLD for Feb. 12, page 368) authorizing the sale of surplus power without the state be urged by thinking citizens. Under this bill the protection afforded by the Fernald act will be preserved, and the state will benefit by the sale of 125,000,000 kw.-hr. which would otherwise run to waste on the system of the Central Maine Power Company alone. Mr. Wyman also says that if the company could obtain this revenue, at least half of it would go to reduce rates to its regular customers, some going to build farm lines and some to pay taxes on the necessary equipment.

Mr. Wyman has also issued a statement replying to former Governor Baxter's attack on the Insull operations in Maine, pointing to what has been accomplished by the Middle West Utilities Company in that state and criticising the narrow-minded attitude evidenced in Mr. Baxter's pronouncement: "Let Insull take his money and go back to Chicago."

Insull's Political Contributions Again Scrutinized

Summoned before the Senate campaign - investigating committee at Washington last Monday, Samuel Insull, head of many public utility companies, was again interrogated concerning his contributions last year to the primary campaign funds of aspirants for political honors in Illinois. He admitted total contributions of $237,925, of which, as previously established, $125,000 went directly to promote the candidacy for United States Senator of Frank L. Smith, then chairman of the Illinois Commerce Commission.

Concerning $40,000 of the total amount—a sum donated to candidates for county offices—Mr. Insull and his counsel, Daniel Schuyler, refused to divulge the names of the recipients. Mr. Insull held that to do so would be a breach of confidence. Senator Reed, chairman of the investigating committee, to which a Supreme Court decision has given augmented authority, gave Mr. Insull until Saturday to get a "release from the obligation of honor" which prevented his testifying in that respect, and also to find out to whose order an admitted check for $190,000 was drawn, Mr. Insull having forgotten. Mr. Insull testified that all the contributions save a negligible amount were made from his private funds and not from the funds of the companies with which he is connected.

More Time at Priest Rapids

Power Commission Extends Construction Period Two Years—Some Other Hydro-Electric Projects

THE Washington Irrigation & Development Company has applied to the Federal Power Commission for an extension of two years in the period allotted for the construction of its project at Priest Rapids on the Columbia River. While determined opposition to the extension is expected to be forthcoming from local irrigation and other interests, it is virtually certain that the commission will grant the extension. The rights were not allowed until after full opportunity had been given all to present their views, and the company has expended $7,000,000, largely in efforts to induce industries to erect plants in the region so as to provide a market for the 750,000 hp. which it is planned to install.

Objections have been filed with the commission in connection with the application of the Northern Connecticut Power Company for a license covering a project on the Connecticut River near Springfield, Mass. The company is not willing to incur the expense of providing locks in the new dam, which will replace the Enfield Dam. It is willing to construct its dam in such a way that the locks can be put in by the federal government at any time it sees fit. The company contends that navigation above its dam is confined solely to pleasure craft. It proposes to install 65,800 hp.

The commission on Feb. 12 departed from its resolutions to grant no rights in the Colorado River basin by issuing a license to the Best Flume & Power Company of Pinedale, Wyo., for a small public utility plant.

The Office of Indian Affairs has reported favorably on the partly constructed project of the Uintah Power Company on Uintah and Pole Creeks in Utah, where 2,500 hp. of primary power is available. The existing plant has been operating without a permit.

The Forest Service will open bids on April 15 for timber contracts in connection with the applications for power rights on Revillagigedo Island, for which several large newspaper enterprises have filed conflicting applications. It has reported unfavorably on the application of a syndicate of Alaskans headed by Harry G. McKain of Ketchikan for a permit to build a dam on Ward Creek on that island. This proposed development is held not to be an economical one, and it would interfere with extensive fish propagation work being conducted there by the Bureau of Fisheries.

Purchases and Mergers

Fitkin Buys West Missouri Power—Doherty Missouri Companies Merge—Other Transfers

AUTHORIZATION is being sought from the Missouri Public Service Commission for the purchase of the West Missouri Power Company by the Arkansas-Missouri Power Company, an A. E. Fitkin subsidiary. The merger company will be known as the Missouri Public Service Company. The West Missouri Power Company's properties lie within a radius of 90 miles south and east of Kansas City. Its headquarters have been at Pleasant Hill, Mo., and those of the purchasing company at Blytheville, Ark. The price is understood to be approximately $6,500,000, and the application to the commission says that a program of expenditure totaling about $852,000 is to be carried out.

Arrangements have been made by the Empire District Electric Company, with headquarters in Joplin, Mo., for the purchase of the Ozark Power & Water Company. The Ozark company supplies wholesale and retail service to an area reaching from Joplin to Springfield on the east. Its most important asset is the dam and generating plant at Ozark Beach, near Forsyth, and its total assets have been estimated at between four and five million dollars. Both the Empire and Ozark companies are Henry L. Doherty properties.

Authority has been granted the Lincoln (Ill.) Water & Light Company to purchase the electric plant and distribution system of Frank B. Hullinger in San Jose, Ill., and also to acquire the Royal Light & Power Company of Delavan, Ill. The latter plant, sold for $45,000, was formerly owned by W. H. Few.

Purchase of the Midwest Electric Service Company, with headquarters at Casper, Wyo., by the Mountain States Power Company, Tacoma, Wash., was announced recently. The Midwest company comprises small generating plants and distributing systems in ten towns in Wyoming and two in South Dakota.

The municipal plant at Arlington, Ore., has been bought by the Sherman Electric Company, which has also recently purchased the Heppner Water, Light & Power Company and the Condon Electric Company. All of these properties are to be tied in with the system of the Sherman Electric Company, ownership of which has recently passed to interests allied with the Pacific Power & Light Company.

Announcement is made of the purchase of the Rockville-Willimantic (Conn.) Lighting Company, operating in the two cities named, and the Fulton (N. Y.) Light & Power Company by the Eastern Gas & Electric Securities Corporation, recently incorporated in Connecticut. The Rockville-Willimantic company has assets of $1,881,000 and a surplus of $89,000.

The St. Lawrence Securities Company is seeking permission to acquire the outstanding capital stock of the Norwood (N. Y.) Electric Light & Power Company.

The Gatineau Power Company, which controls the power projects at Chelsea, Farmers Rapids and Paugan Falls on the Gatineau River in the Province of Quebec, has acquired two small existing plants for about $350,000. One is the 600-hp. Bonhomme electrical plant on the Blanche River, in operation since December last, which has been purchased for about $100,000. The other is the 1,000-hp. plant of the Papineauville (Que.) Electric Company, for which about $250,000 was paid.

No Progress Reported on Osage River Power Plan

On Feb. 16 there was a conference at Kansas City called to promote the project for a twenty-million-dollar hydro-electric plant on the Osage River, near Bagnell, Mo., to which a number of previous references have been made in these columns. The conference was attended by B. J. Denman, president United Light & Power Company of Illinois, which controls the Kansas City Power & Light Company; J. F. Porter, president Kansas City Power & Light Company; Walter Cravens and R. W. Street, president and vice-president of the Missouri Hydro-Electric Power Company, which is promoting the development; H. J. Deutschbein of New York, president of the Foundation Company, and representatives of bankers. Cost of power delivered at Kansas City was the crucial point, and the meeting adjourned without advancing the project beyond the tentative stage.

North American Expansion Program in Wisconsin

Announcing completion of the 1927 budget of the Milwaukee Electric Railway & Light Company and five associated North American Company subsidiaries in Wisconsin and Michigan, S. B. Way, president of the company first named, says that the expansion program is the largest these utilities have ever undertaken, reaching $11,449,000 as compared with $9,870,000 last year. About half the appropriations will be for light and power purposes, divided as follows: Milwaukee Electric Railway & Light Company and Wisconsin Electric Power Company, in the Milwaukee district, $3,556,179; Wisconsin Gas & Electric Company, operating in Racine, Kenosha, Waukesha and a score of smaller places, $752,304; Wisconsin Traction, Light, Heat & Power Company, in the Appleton district, $520,800; Badger Public Service Company, operating in Sheboygan County, $119,287; Peninsular Power Company, operating in northern Wisconsin and Michigan, $456,953.

While there will be added construction work this year at the Lakeside plant, there will be no additional units built until 1928, as the high-pressure boiler and new turbine installed last year will be sufficient to take care of Milwaukee's growing needs for the present. One of the most important items of activity will be extended electrical service to farmers. Continuing the program launched last year, the company hopes so to extend its lines during 1927 as to attain its goal, which is to have every farm in its territory within reach of its lines.

Optimism in Kentucky

Utilities Association Men Encouraged and Exhorted by Leaders in the Electrical Industry

ELECTRIFICATION of the home is one of the primary jobs of the central-station industry, declared R. F. Pack, president of the National Electric Light Association, before 389 delegates and guests at the tenth annual meeting of the Kentucky Association of Public Utilities at the Brown Hotel, Louisville, Feb. 18-19. "Data on the use of electrical energy by residential customers," said Mr. Pack, "show that the average cost of electricity for household lights and appliances is only 8 cents a day for each home in the United States, and this expenditure is only 0.63 per cent of the family budget. This is far too low and should be at least twice as much. Compared with the uses of electrical energy in industry the electrifying of the home is a field that has hardly been touched."

T. B. Wilson, president of the Kentucky association and vice-president and general manager of the Louisville Gas & Electric Company, in his opening address reviewed the progress and growth of the industry during the last year, pointed to its substantial position and predicted more rapid increases in growth because of the public's increasing appreciation of the value of the service.

Harry Reid, president of the National Electric Power Company, related incidents in his 20 years' experience in building and developing electric utilities in Kentucky and compared the tribulations of operating a small light plant in those days with the convenience and superservice now made possible by the construction and interconnection of large hydro-electric and steam plants.

Publicity departments of public utility companies were urged to make the fullest use of the daily press by Brainard Platt, assistant to the vice-president of the Louisville *Courier-Journal and Times*. At the same time, he cautioned the utilities against trying to get material into the news columns which really belongs in the advertising section.

Possibilities of women employees of utilities as a means of better merchandising of appliances to the housewife were stressed by Helen E. Steiner, chairman of the women's committee, East Central Division, N.E.L.A. A plea for better understanding between utility employees, stockholders and customers was made by Dean W. M. Anderson of the University of Louisville, who likened this triumvirate to an equilateral triangle surrounding the company.

Utility companies must earn the public esteem by action and not mere words, L. S. Streng, vice-president in charge of operations of the Louisville Gas & Electric Company, contended in a paper "Acting—Not Advertising—Builds Good Public Relations," read by Vernon C. Bailey, assistant to the sales manager of the company.

Continuation of the study of farm electrification was urged by Dr. E. A. White, director of the National Committee on the Relation of Electricity to

Agriculture. He pointed out that the utilities should not become discouraged because the rural load is at present unprofitable and cited the case of the domestic-customer load in urban communities, which it has been necessary to develop in order to put it on a paying basis.

The following officers were elected for the ensuing year: President, W. R. Power, general manager Kentucky & West Virginia Power Company, Ashland; first vice-president, Samuel Riddle, vice-president Louisville Railway Company; second vice-president, L. B. Herrington, president Kentucky Utilities Company, Louisville; treasurer, A. A. Tuttle; secretary, E. F. Kelley.

Service from Dix Dam Spreading in Kentucky

The major construction project completed by the Kentucky Utilities Company during 1926 was the 66,000-volt double-circuit steel-tower line, 72 miles long, between Paducah and Earlington, Vice-president L. B. Herrington told the district managers and superintendents of that company when they met at the Brown Hotel, Louisville, during the course of the meeting of the Kentucky Association of Utilities last week. This line interconnects all the important generating stations of the company in western Kentucky and puts an abundance of power at the disposal of industries in Paducah. Large steel transformer substations were built at Paducah and Earlington to handle the exchange of energy over the new line.

The power produced at the Dix Dam plant of the Kentucky Hydro-Electric Company, Mr. Herrington said, is rapidly being absorbed by the cities and industries in central and southern Kentucky. It now serves or soon will serve Louisville, Lexington, Paris, Cynthiana, Winchester, Richmond, Danville, Shelbyville, Harrodsburg, Bardstown and many other places.

Commercial Section Advances Water-Heating Survey

Definite plans for making a survey of metered water heating were formulated at a meeting of the water-heating committee of the Commercial National Section of the National Electric Light Association held in San Francisco a week or two ago, and it was decided to make a preliminary survey of a small group of heaters to determine costs and indicate methods for making a complete test later. It is hoped that a series of tests can be made on groups of heaters which will be varied as to size and type to indicate what size and type of heater the industry should recommend to the public. In addition to pointing the way to a proper water-heating policy, the tests will give demand, diversity, load factor and kilowatt-hours for groups of heaters so that central-station companies will have the necessary characteristics of the load from which a proper rate may be made. An engineering committee was appointed to work out the method of making the test and to make a preliminary survey.

California 1927 Budgets

Great Western to Build 220-Kv. Line from Sacramento to Bucks Creek —Plans of San Joaquin

A 100-MILE, 220-kv. steel tower transmission line from the Brighton substation of the Great Western Power Company of California, near Sacramento, to the Bucks Creek generating plant of the Feather River Power Company is one item in the 1927 construction budget of the company first named. This new line will give the Great Western four feed lines from its sources of power supply directly into the heart of its territory. It will also strengthen the connection with the San Joaquin system, with which it was tied in last year by a 105-mile steel-tower line from the Brighton substation to the Wilson substation near Merced. Substations and distribution lines are to be built throughout the territory. More than eight millions is apportioned to this company for new construction.

The San Joaquin Light & Power Corporation plans substantial improvements to its Bakersfield steam plant. A 110-kv. line will be built from this plant to the Rio Bravo substation, near Shafter. The construction budget for the San Joaquin exceeds $4,000,000. Its subsidiary, the Midland Counties Public Service Corporation, will spend $403,000 for construction purposes.

Total construction and operating budgets of the three associated companies for 1927, Vice-president A. Emory Wishon announces, will be in excess of twenty millions.

P. S. of N. J. Electric Budget Is $25,461,578

The Public Service Corporation of New Jersey's electric operating department's portion of this year's budget is $25,461,578, of which sum about $2,500,000 will be used for the installation of the fifth unit of boilers, consisting of three of 2,360 hp. each, for the Kearny generating station. There are twelve boilers at the station now, and the extra three will provide for the maximum output planned for the first unit of the plant.

Approximately $12,000,000 is assigned to the development of electric transmission facilities. Of this sum about $7,000,000 will be used for the building of new switching stations, similar to those at Athenia and Trenton. Other transmission items include extension of facilities in the various divisions such as change-overs for several substations, new transmission circuits, new switching equipment at Essex station and construction of duplicate transmission lines over separate routes to various substations. For substations and distribution purpose there is available something more than $9,000,000. New substations will be erected at Westwood, Rahway, Union City and Princeton. Substations at Ridgewood, Elizabeth, Cranford, New Brunswick, Washington Avenue, Newark; Garfield Avenue, Jersey City, and Olden Avenue, Trenton, will be reconstructed. Extensions will be made to Englewood substation and additional equipment will be provided for the Metuchen switching station. About $1,000,000 will be spent for underground conduits in congested sections and another $1,000,000 for reinforcement of distribution lines.

One of the interesting expenditures contemplated is $50,000 for aërial photography, consisting of hundreds of pictures taken in the air and to be pieced together as a mosaic, giving a comprehensive outline of the company's territory.

Briefer News

Fighting Hydro Commission Charges in Ontario.—The Central Ontario Power Association, which will have as one of its main objects the fighting of increased Hydro charges, came into being

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 1, page 80.]

Oklahoma Utilities Association—Huckins Hotel, Oklahoma City, March 8-10. E. F. McKay, 307 Local Building, Oklahoma City.

Northwest Electric Light and Power Association, Engineering Section—Portland, Ore., March 10 and 11. O. L. LeFever, Northwestern Electric Co., Portland.

American Institute of Electrical Engineers—Southwestern District, Kansas City, March 17-18; Middle Eastern District, Bethlehem, Pa., April 21-23; Northeast District, Pittsfield, Mass., May 25-27. F. L. Hutchinson, 36 West 39th St., New York.

National Electrical Manufacturers' Association, Policies Division.—Briarcliff Manor, N. Y., March 17-18. S. N. Clarkson, 30 East 42d St., New York.

Illinois State Electric Association—St. Nicholas Hotel, Springfield, Ill., March 17 and 18. R. V. Prather, 205 Illinois Mine Workers' Building, Springfield, Ill.

Northwest Electric Light and Power Association, Accounting Section—Gasco Building, Portland, Ore., March 21. W. L. Fitzpatrick, Mountain States Power Company, Tacoma, Wash.

Southeastern Division, N.E.L.A.—Peabody Hotel, Memphis, Tenn., April 13-15. C. M. Kilian, 404 Wynn-Claughton Bldg., Atlanta.

Southwestern Division, N.E.L.A.—New Orleans, April 26-29. S. J. Ballinger, San Antonio Public Service Company, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 26-29. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Nebraska Section, N.E.L.A.—Grand Island, Neb., April 27-28. H. M. Davis, 1519 O St., Lincoln.

American Electrochemical Society—Benjamin Franklin Hotel, Philadelphia, April 28-30. Colin G. Fink, Columbia University, New York.

Missouri Association of Public Utilities—Cape Girardeau, May 5-7. F. D. Beardslee, 315 North 12th St., St. Louis.

Middle West Division, N.E.L.A.—Topeka, Kan., May 18-20. H. M. Davis, 1519 O St., Lincoln, Neb.

Canadian Electrical Association—Clifton Hotel, Niagara Falls, Ont., May 25-27. J. B. Woodyatt, Southern Canada Power Company, Montreal.

National Electric Light Association—Atlantic City, N. J., June 6-10. Paul S. Clapp, 29 West 39th St., New York.

at a meeting of representatives of various municipalities held in Cobourg on Feb. 17. F. L. Mason of Oshawa was elected president of the new association.

Expansion in Mississippi.—The Mississippi Power & Light Company, Jackson, Miss., will construct with its own forces during 1927 110-kv. lines from Indianola, Miss., to Grenada, Miss.; from Jackson to Amite, La., and from Cleveland, Miss., to Memphis, Tenn. It will also build about 200 miles of high-tension line in various parts of the state and reconstruct distribution systems in about 20 towns.

Barstow Florida Company to Build Station at Avon Park.—The Florida Public Service Company, a Barstow subsidiary, has acquired property at Avon Park, in the south central part of Florida, about 25 miles south of Lake Wales, as the site for a new steam generating power station, the initial capacity of which will be 12,500 kw. The station is to be patterned after the recently completed power plant at Benson Springs, 150 miles further north.

Interconnection in North Dakota.—The Hughes Electric Company has applied to the North Dakota Board of Railroad Commissioners for authority to construct a 50-mile high-tension transmission line from Bismarck to Tappen. When this line is built the Hughes company will have lines extending from Belfield, in the western part of the state, to Tappen, about 170 miles. The board is encouraging the interconnection of all power lines in the state, regardless of their ownership. A gap between Tappen and Medina is expected to be closed this year by the Otter Tail Power Company.

Time Is Asked in Which to Compile Conowingo Costs.—An inquiry was conducted jointly last week at Washington by the Federal Power Commission, the Pennsylvania Public Service Commission and the Maryland Public Service Commission into the preliminary costs of the Conowingo hydro-electric development in Maryland. The licensees, the Susquehanna Power Company and the Philadelphia Electric Company, asked deferment until the development is completed in 1928 of submission of costs of properties and rights acquired prior to the federal license granted on Feb. 20, 1926. The joint commissions took the request under advisement for early disposal.

Fourteen-Million-Dollar Program at St. Louis.—The Union Electric Light & Power Company of St. Louis will spend approximately $14,000,000 for improvements during 1927, according to President Louis H. Egan. On an addition to the Cahokia power plant which will eventually cost $7,900,000, $4,500,000 will be spent this year, bringing the total investment in the plant to $30,000,000. As already reported, about $1,000,000 will be expended in connection with the generating plant at Venice, Ill., recently purchased from the Illinois Power & Light Corporation. This plant will be connected with Cahokia by a 66,000-volt transmission line, now under construction. Another $3,000,000 will be expended on new substations and line extensions in St. Louis. The remodeling of the company's main office building at Twelfth and Locust Boulevards is rapidly nearing completion. This improvement will cost the company $1,000,000.

Mountain Lion Is Electrocuted on High-Tension Line.—Birds are so frequently responsible for line interruptions that their self-destructive accomplishments in this direction are an old story, and domestic cats and other small animals have also been guilty; but it is seldom that an animal the size of a mountain lion climbs a pole and finds its way into a high-tension circuit. The photograph shows a mountain lion or bobcat which climbed a

high-tension pole of the Public Service Company of Colorado in the Rocky Mountain region and caused a brief interruption. The patrolman found its frozen body.

Rural Charters in Pennsylvania.—Announcement comes from Harrisburg, Pa., that Governor Fisher does not intend to follow the policy of his predecessor, Governor Pinchot, by holding up applications for charters for rural service approved by the Public Service Commission. For ten of the 48 charters which Governor Pinchot left unsigned on the ground that their proposed rates were too high new applications have been made, and the same action is likely to be taken in the remaining cases.

Lighting of Lincoln Memorial in Washington to Be Improved.—Defects in the natural lighting of the statue in the Lincoln Memorial at Washington are about to be corrected by the introduction of improved artificial illumination worked out by the illuminating engineering laboratory of the General Electric Company. Twelve floodlamps will be installed on one side and above the ceiling and twelve of less intensity on the other side to dissipate in part the shadows cast by the first group. A few of the marble slabs in the ceiling are to be replaced with special glass which will both conceal the light sources and diffuse the light. Behind each of the remaining 125 slabs is to be a lamp of less intensity than the floodlamps, thus providing a soft interior illumination at night. The wiring system is to be so arranged that certain of the floodlamps may be turned on while others are dimmed, according to the sunlight.

National Electrical Code Explained in Florida.—A paper on "The Founding and Developing of the National Electrical Code," read by C. M. Goddard, formerly electrical engineer with the New England Insurance Exchange, was a leading feature in the program of the joint annual conventions of Florida electragists and Florida municipal electricians held at Orlando on Feb. 15. C. S. Graham of Jacksonville, H. B. Kirkland of New York City, T. E. Cornell of Syracuse, N. Y., and C. J. Zeigler of Boston were others who took a prominent part.

Association of Electragists Has New Plan for Field Work.—R. C. Hill, field director for the Association of Electragists International, announces the adoption of a new phase of activity involving increased attention to local work. To further this object the United States and Canada will be divided into ten sections with a trained field man for each. The service rendered to local branches will be of four kinds—organization service, technical service, business service and special service, the last named dealing mainly with the insurance offered through the A.E.I. to its members.

Foshay to Erect Twelve-Story Office Building in Minneapolis.—Plans for a million-dollar twelve-story office building at Minneapolis have been announced by W. B. Foshay, president of the W. B. Foshay Company. The structure will be built on the south end of the block between Marquette and Second Avenue South and Eighth and Ninth Streets and will be surrounded on three sides by a two-story building. The main portion of the building will be 70 ft. square, rising six stories to a setback of 20 ft. rising four more stories. The upper two stories will be set back 20 ft. from the four-story portion. The height of the building will be approximately 170 ft.

Preliminary Bore of Moffat Tunnel "Holed Through."—Three and a half years' work on cutting the 6-mile Moffat Tunnel through the Continental Divide for railroad traffic, water purveyance and communication and power cables culminated on Feb. 18 in the "holing through" of the smaller bore, 8 ft. in diameter, which will be used as an aqueduct to carry water from the high Western plateau into Denver. The two ends of the main tunnel will soon meet also, letting daylight through the Rocky Mountains. About 4,000 hp. in electric motors has been and is being used in the work of excavation, mostly of General Electric manufacture. When the double tracks come to be laid the tunnel will be electrified and electric locomotives will haul the trains through it.

Men of the Industry

W. J. O'Brien Elected Vice-President of Memphis Utility

W. J. O'Brien has been made vice-president and general manager of the Memphis Power & Light Company by the board of directors of that organization. Mr. O'Brien's promotion came in recognition of his efficient service and proved ability, according to a statement made by T. H. Tutwiler, president. Mr. O'Brien joined the official family of the light and power company as assistant to the president on Jan. 1, 1926.

Mr. O'Brien removed to Memphis from Olean, N. Y., where he was district manager for the Niagara, Lockport & Ontario Power Company for a period of six years. In joining the force of the Power & Light company, Mr. O'Brien gave particular attention to operating matters, including the development of new-business and merchandising departments.

He is a native of New Orleans, and completed his college course at Purdue University in 1905. Following graduation he became connected with the Denver Gas & Electric Company as engineer, remaining there about three years. He left that connection to become general superintendent of the Pueblo Gas & Fuel Company, where he remained for two years. That connection was severed to accept a position at Helena, Ark., as manager of the Helena Gas & Electric Company. Leaving Helena, he was associated with public utilities in southern Texas, whence he went direct to New York.

Messrs. Herrington and Bogard of Louisville Promoted

Lewis B. Herrington will be chosen to succeed Harry Reid as president of the Kentucky Utilities Company at the annual meeting of the company directors in March. This announcement was made by Mr. Reid at the recent yearly meeting of the officers, department heads and district managers of the company. Mr. Herrington will also become president of the Kentucky Hydro-Electric Company and Old Dominion Power Company when the directors meet. George T. Bogard will be named vice-president in charge of operations, and Arthur A. Tuttle will become vice-president and treasurer. Mr. Herrington has been connected with the company for twelve years. He has been vice-president and general manager since April, 1917. Mr. Bogard has been chief engineer since September, 1917, and Mr. Tuttle has been secretary and treasurer since February, 1914.

Mr. Herrington's interest in the public utility field began in 1904, when, with associates, he built the electric light and power plant at Richmond, Ky. Later he and his friends built and operated an electric light and power system in Ohio and the telephone utility at Orlando, Fla. All these companies were afterward sold, the Richmond property becoming part of the Kentucky Utilities Company system.

The plan to develop the great hydro-electric power plant on the Dix River originated with Mr. Herrington and came to fruition through his persistent efforts to attract to the project men

L. B. HERRINGTON

with sufficient resources to insure its success. He has been connected with the Kentucky Utilities Company for twelve years. Mr. Herrington was twice elected to the Kentucky Legislature, in 1910 and 1912, and he has an extensive acquaintance throughout the state. He has been president of the Kentucky Association of Public Utilities and of the Kentucky Ice Manufacturers' Association. He is interested in the work of the National Electric Light Association and has been president of its East Central Geographic Division and chairman of the Public Relations Section of that division.

Mr. Bogard was born at Golden Pond, Ky. He is a graduate of the University of Kentucky, and has been

G. T. BOGARD

connected with the Kentucky Utilities Company since its organization in 1912.

Mr. Tuttle was born at Somerset, Ky., and has been connected with the company since December, 1912. He was engaged in the banking business at Somerset before entering the public utility field.

Wenzel Koch has been named manager of the Wisconsin Gas & Electric Company's properties at Cudahy and South Milwaukee.

Ernest Huntington has been appointed engineer of electric generation of the Rochester (N. Y.) Gas & Electric Corporation to take charge of the operation of stations and substations.

N. D. Holmes, formerly connected with the New England Power Company, is now affiliated with the Staten Island Edison Corporation in the capacity of assistant chief engineer.

Thomas A. Edison left his home in West Orange, N. J., Feb. 17 for Fort Myers, Fla., where he will spend a two months' vacation.

Dwight N. Lewis, for 25 years associated with the Iowa Railroad Commission, which he joined as a clerk, and now serving his second term as commissioner, has been appointed commerce counsel, succeeding Judge John H. Henderson. Governor Hammill has not indicated his choice for the commission to fill the vacancy caused by Mr. Lewis' advancement.

Stephen J. Gilles, treasurer and general manager of the Hunter Arms Company, Inc., Fulton, N. Y., has been elected president of the Fulton Light, Heat & Power Company. Other officers elected were H. M. Whiting of Pine Orchard, Conn., vice-president; John T. Sullivan of Fulton, secretary-terasurer, and Milton Warner of New York City, manager-director.

E. P. Lovejoy, Jr., has affiliated himself with the National Electrical Manufacturers' Association, New York, to engage in publicity work for that organization. Mr. Lovejoy has been active in promoting the publicity work of the association for some time past, and he is therefore thoroughly familiar with its problems. He was formerly connected with the news bureau of the General Electric Company at Schenectady, but two years ago was transferred to New York to represent the publicity department at the executive offices of the company.

Clifford L. Harrod of Indianapolis, consulting electrical engineer of the Indiana Coal Operators' Association for the last seven years, has been named general manager and industrial commissioner of the Indianapolis Chamber of Commerce. Selection of a man who has the combined qualifications of being an Indianapolis man, a knowledge of transportation and extensive experience in public utility work was made by the committee after holding eighteen meetings in which more than thirty candidates were interviewed. The appointment will become effective about the middle of March.

Zay Jeffries, consultant of the incandescent lamp department of the General Electric Company at Nela Park, Cleveland, was made the recipient of the James Douglas medal for 1927, awarded Feb. 16 by the American Institute of Mining and Metallurgical Engineers for distinguished achievement in non-ferrous metallurgy. This award was given "for contributions to our knowledge of the hardness and structure of metals." Mr. Jeffries has

work in metallurgy for the Electric Railway Improvement Company, the Lincoln Electric Company, the Aluminum Company of America, the National Tube Company and other industrial organizations in addition to his research work for the incandescent-lamp department of the General Electric Company. He has to his credit considerable original work on tungsten used for lamp filaments, radio tubes and other purposes and on the high-strength aluminum alloys.

William Kleine, chief electrical engineer for the city of Cincinnati, has resigned. Mr. Kleine, who has been identified with the electrical industry for 30 years, holds several patents for electrical inventions.

George J. Smith, formerly connected with the Binghamton (N. Y.) Light, Heat & Power Company, has joined the engineering department of the Associated Gas & Electric Company at Colliers, N. Y.

Arthur I. Jones, district engineer of the General Electric Company for the Rocky Mountain region, with headquarters at Denver, has been appointed assistant district manager. Mr. Jones has been with the General Electric organization for 26 years. He is a member of the American Institute of Electrical Engineers.

William H. Atkins, vice-president and general superintendent of the Edison Electric Illuminating Company of Boston, was honored by election as vice-president of the Edison Pioneers on the recent eightieth-birthday celebration for Mr. Edison. Mr. Atkins has served the Boston company for almost forty years and was recently appointed vice-president of that central-station organization, as announced in the ELECTRICAL WORLD.

James A. Davies has been appointed general superintendent of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company. Mr. Davies, who was assistant general superintendent for eight years, was appointed to fill the position made vacant by the recent death of H. M. Giles. With a service record of more than seventeen years in the employ of the Westinghouse organization, Mr. Davies has worked his way up through the ranks from the designing room to his present position.

Carl A. Whiteman, formerly manager of the municipal electric light and power plant of the borough of Emporium, Pa., has recently become power engineer for the Erie Lighting Company. Mr. Whiteman was graduated from the school of electrical engineering at Penn State and then entered the employ of the General Electric Company.

Robert K. Carver and **Frank H. Miller** have been appointed to the respective positions of service manager and operating superintendent for the Public Service Company of Northern Illinois at Waukegan, according to a recent announcement by Vice-president C. W. Bradley. Mr. Carver has been attached to the office of the company's service engineer in Chicago for approximately a year, prior to which time he served in the right-of-way department. Mr. Miller also comes to Waukegan from the Public Service Company's general office at Chicago, where he served for a short time as assistant engineer in the operating department. Before that he was employed by the company at Crystal Lake and Pontiac, in various engineering capacities. Mr. Miller is an electrical engineer, having received his training at the University of Kansas.

W. E. Wood New President in Richmond

William E. Wood, who was elected to succeed Luke C. Bradley in the presidency of the Virginia Electric & Power Company, as announced in the Feb. 12 issue of the ELECTRICAL WORLD, is a veteran in the service of the Stone & Webster organization, though an officer of the Richmond utility only since the summer of 1925. He joined the Boston office of Stone & Webster immediately after being graduated from the Georgia Institute of Technology in 1907 and subsequently was transferred to the Jacksonville (Fla.) Traction Company. Mr. Wood remained with the Jacksonville utility until 1916, when he removed to Houston in the capacity of general superintendent. The following year he was appointed to the El Paso Electric Railway, but after a short connection there he became manager of the Galveston Electric Company. He returned to Houston as manager of the Houston Electric Company before entering the office of vice-president and general manager of the Virginia Electric & Power Company when control of the properties was taken over by Stone & Webster in 1925.

W. E. WOOD

During his career in the public utility field in the Southwest Mr. Wood was active in association work, having served as president of the Southwestern Public Service Association.

Leonard Cahoon, manager of the Stratton-Cahoon Company, sales engineers of Salt Lake City, was elected president of the Engineering Council of Utah at the recent annual election of officers of that organization. A native of Salt Lake City and a graduate of the University of Utah, Mr. Cahoon has been a prominent figure in engineering circles for a number of years. He is a member of the American Society of Mechanical Engineers and of the Utah Society of Engineers, having served on the executive committee of the latter organization and also as president. Mr. Cahoon is also a past-president of the local section of the American Society of Mechanical Engineers and is a member of the executive committee of that section for 1927.

Carl L. Wernicke, for 22 years associated with the Westinghouse Electric & Manufacturing Company, over 21 of which have been spent on the Pacific Coast, has resigned recently to become manager of the Iona Company, Portland. His affiliation with the Westinghouse interests began in 1904, and during that period of service he took charge of the Westinghouse exhibit at the Lewis and Clark Exposition in 1905, served in the San Francisco office of the company and was branch manager at Portland until he was transferred to special work in the last-named territory in central-station equipment. He engaged in this work until his recent resignation.

William S. Schmidt has been appointed assistant chief electrical engineer of the Pennsylvania-Ohio Electric Company, Youngstown, under a reorganization of the electrical department which includes the formation of four distinct sub-departments with an engineer or superintendent in charge of each, the four forming an electrical council for the chief engineer. Mr. Schmidt will be in charge of metering, right-of-way, load dispatching and general engineering. **Theodore D. Ramon** has been named assistant electrical engineer in charge of statistics and records and **N. A. Hooper** superintendent of electrical equipment in charge of substation operation, construction and maintenance. **Karl B. Crawford** has been appointed superintendent of lines, in charge of operation, construction and maintenance of transmission and distribution lines.

Obituary

Iner R. Carlson, who had been connected with Stone & Webster in Orlando, Fla., recently died there. Mr. Carlson had been in Orlando for about two years. He was formerly connected with the Stone & Webster organization at Keokuk, Iowa, and at Calumet, Mich.

George E. Woods, a vice-president of the Consolidated Gas Company of New York, died Feb. 5 at his home in Astoria, Long Island. A native of Henderson, Ky., Mr. Woods first entered the public utility field as an employee of the Evansville Gas & Electric Company. Subsequent connections followed with the Detroit Gas Company, the Pulaski Gas Light Company, the Little Rock Electric Light Company and the Standard Gas Light Company of New York. In 1901 he was appointed engineer of manufacture of the Consolidated Gas Company of New York, later becoming assistant chief engineer, chief engineer and finally a vice-president. Mr. Woods was a member of the American Society of Mechanical Engineers, the Illuminating Engineering Society and several other technical organizations.

Financial and Corporate

Utility Stocks Firm but Quiet
Counter Shares Make Gains
Bonds Show Further Advance

NOTWITHSTANDING the highly favorable financial reports already published by some of the power and light companies and foreshadowed by others, the stocks of these utilities are practically neglected in the markets. Much speculation exists with regard to the probable duration of the general concentration on rails. It is of significance that when slight breaks occurred in rail or industrial issues recently some of the utility stocks immediately moved up. Certain market observers look for a broad movement in these issues just as soon as interest in the present favorites flags.

Among the common stocks which have shown signs of life are Montana Power, American Water Works & Electric, Columbia Gas & Electric and a few lower-priced issues, such as American & Foreign Power. Over the counter trading shows more activity than either exchange or curb business. Republic Railway & Light common gained three points to 120, and El Paso Electric preferred A and Central Maine Power 6 per cent preferred made gains of several points. Otherwise preferred issues are still quiet, broadly speaking.

Further gains have been made by several of the high-grade bond issues. The average of ten representative power and light bonds computed by the ELECTRICAL WORLD made a further marginal gain to 102.6 this week, against 101.3 at the beginning of the year and 98.3 this week last year.

Company Reports

The following statements of earnings have been issued by electric light and power companies:

Name of Company	Gross Earnings Twelve Months Ended Dec. 31. 1926	1925
Adirondack Pwr. & Lt.*	$9,347,451	$8,404,042
Associated Gas & Electric	29,284,246	19,451,146
Cities Service*	26,682,295	19,956,292
Jamaica Public Service	652,104	625,275
Mississippi River Power	3,589,018	3,233 409
Northern Ohio Power	12,040,841	11,499,698
Portland Electric Power	11,763,567	11,045,063
Shawinigan Water & Power	7,660,208	6,702,034
Syracuse Lighting	6,675,317	6,072,197
Western United Gas & Elec.	6,758,886	6,044,052

* Twelve months ended Jan. 31, 1927 and 1926.

Brooklyn Edison to Increase Capital

Stockholders of the Brooklyn Edison Company will vote Feb. 28 on increasing the authorized capital stock from $75,000,000 ($74,993,000 outstanding) to $100,000,000, par $100. In explaining the proposed increase Matthew S. Sloan, president, said: "Since practically all our present authorized capital stock is issued and in the hands of the public, it is a matter of corporate routine to ask shareholders to authorize the creation of more stock. The proposal is being submitted to them this month to avoid calling a special meeting for the purpose later in the year. We will do some financing this year, but whether in bonds or stocks will depend on market conditions. We probably will not initiate this financing for another five or six months."

Baltimore Company Sells Stocks to Customers.—Customers of the Consolidated Gas, Electric Light & Power Company have been offered small lots of the company's 6 per cent cumulative preferred stock on the monthly-payment plan of $8 monthly on each share subscribed for. Only customers of the company are entitled to subscribe to the stock, and no more than ten shares can be acquired by one person.

Pennsylvania Power Stock to Be Split

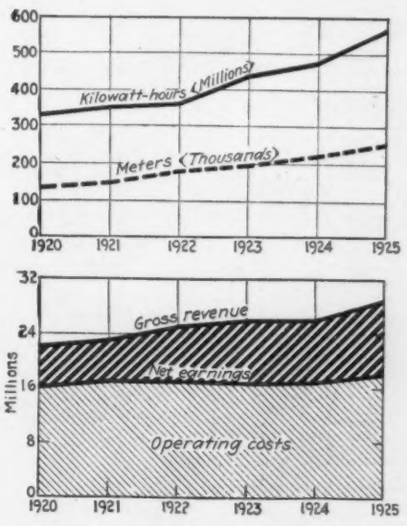
Stockholders of the Pennsylvania Water & Power Company will vote at a special meeting May 10 on the plan proposed by the board of directors of the company to split up the present holdings on the basis of four shares of no-par-value stock for each of the present shares of a par value of $100. The plan includes the issuance of 540,000 shares of no-par-value stock for the present authorized 135,000 shares, par value $100.

Of the present authorized issue of 135,000 shares there are 107,462 actually outstanding. After the exchange the company will have in its treasury a balance of 110,152 shares of no-par-value stock to be used for corporate purposes.

Current Methods of Financing—IV

Recent Debenture Issues Illustrate Uses of These Securities for Refunding and for Other Corporate Purposes

IN ADDITION to the usual purposes of the sale of debentures already referred to under the above heading, refunding operations are frequently carried on through this medium. Present market rates are particularly favorable to such refunding, and among issues currently offered to the public several are designated "for refunding and other corporate purposes." Two issues recently sold—a nine-and-a-half-million-dollar issue of Illinois Power & Light debentures and a seven-and-a-half-million-dollar Interstate Power issue—illustrate certain features of this type of security.



FIVE YEARS' PROGRESS OF ILLINOIS POWER & LIGHT

In accordance with current practice, both these issues are of relatively short duration, one being for 30 years and the other 25. The purpose of the former is the retirement of approximately an equal amount of 30-year 7 per cent debentures sold in 1923, which issue has been called for redemption April 1 next at 105 and accrued interest. It is apparent that a material saving will be effected, a 7 per cent issue being replaced by one with a 5½ per cent coupon.

The creation of a purely refunding offering points back to the purpose of the original issue. The financial set-up would easily have permitted a further issue of senior securities had the company so desired, but by increasing junior financing the company saved its mortgage bonds for later use, maintained a balance in capital structure and is now able to refund this issue at an attractive rate.

The equity behind the present issue is represented by $34,500,000 first and $1,875,000 participating preferred stock as well as 400,000 shares of common. Apparently the value of the properties is well in excess of the total debt of the corporation and its subsidiaries. The reason for increasing junior financing, then, is evident, and the company has succeeded in doing so at a rate which many companies are obliged to pay for senior money.

The security of these debentures, the issue of which is closed, consists of careful restriction on future issues of the company. The trust agreement provides for the formation of a sinking fund into which $80,000 will be paid on each interest date during the life of the issue. It is estimated that this will retire over 50 per cent of the issue at or before maturity.

While the Interstate Power debentures were also sold for refunding purposes, the issues differ in certain important respects. The Illinois Power issue is sold to refund a like issue, while the Interstate debentures, along with the recently sold twenty-million-dollar issue of first mortgage bonds, are to be used in the retirement of previous bond issues of the company as well as of underlying bonds and preferred stocks of subsidiary companies. This is designed to permit consolidation of the properties into a single operating unit. As in the case of the Illinois Power & Light financing, it may be assumed that senior financing could have been resorted to had the company so desired. Estimating common stock at a purely nominal figure of $25 a share and preferred stock at the current price of $94, senior financing could have been increased by the amount of the debenture issue and still be less than 70 per cent of the company's total capitalization in the form of securities. The sale of debentures provides for the retirement and consolidation process without the aid of further senior financing.

While Illinois Power & Light makes provision for a sinking fund to guarantee the debentures, as well as placing a careful restriction upon further issue, the guarantee in the case of Interstate Power depends upon the latter provision. The mortgage under the first mortgage bonds of the latter company provides for maintenance and renewal and replacement reserves in which shall be set aside each year "amounts at least equal respectively to 8 and 5 per cent of the gross operating revenue of the company and its subsidiaries, as defined in the mortgage, less charges for amounts actually expended for such purposes."

Thus both companies have been able to carry on refunding operations and have reduced annual interest charges, without increasing their senior financing. In one case there is the added advantage of a betterment of the capital set-up.

Laclede Company Increases Dividend Rate.—Directors of the Laclede Gas Light Company have declared a quarterly dividend of $3 a share on the common stock, placing it on a $12-a-year basis, compared with $8 regular and $2 extra previously. It is payable March 15 to holders of record March 1.

New Capital Issues

During the week ended Feb. 24 the Southwestern Light & Power Company issued first mortgage 5 per cent gold bonds, series A, to the amount of $6,500,000, the price being 97 and interest, to yield about 5.20 per cent. These bonds will be a direct obligation of the company and will be secured by an absolute first mortgage on all of the permanent property rights and franchises of the company now owned and hereafter acquired.

Class A stock of the Associated Gas & Electric Company was offered to the amount of 100,000 shares at $40.50 per share. The proceeds of the recent issue of 5½ per cent convertible gold debentures and of this issue of class A stock are being used to acquire additional public utility properties or securities deriving their income from such properties, for further simplification of the capital structure of the Associated system, for new construction and for other corporate purposes.

Canadian Utility Issues First Report.—The first operating report of the Ottawa River Power Company, Ltd.,

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday Feb. 21	Low 1927	High 1927
ABITIBI PWR. & PAPER, 4% com.—no par	90	83	90
Adirondack Pwr. & Lt.—7% pf.	107½	101*	108½*
Adirondack Pwr. & Lt.—8% pf.	113	101*	115*
Ala. Pwr., 7% pf.	109½	....	....
Allis-Chalmers Mfg., 7% pf.	k109½	109	111
Allis-Chalmers Mfg., 6% com.	95½	88	95½
Aluminum Co. of Amer., com.	72	....	....
Aluminum Co. of Amer., 6% of.	102	101½	102½
Amer. & Foreign Pwr., pf. 25% pd.	m110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	88	86½	89½
Amer. & Foreign Pwr., com.—no par.	21½	18½	23
Amer. Bosch Magneto, com.—no par	k 16½	13	17½
Amer. Brown Boveri Elect.	36	34½	39½
Amer. Brown Boveri Elec., pf. $7	k 96½	95½	98
Amer. Gas & Elec., 6% pf.—no par.	96	....	....
Amer. Gas & Elec., com.†—no par.	70½	68½	100½
Amer. Lt. & Trac., 6% pf.	112	105*	132*
Amer. Lt. & Trac., com.†	231	224½	233
Amer. Pwr. & Lt., 6% pf.	100	97½	100½
Amer. Pwr. & Lt., com.†—no par.	56½	54	61½
Amer. Pub. Serv., 7% pf.	96½	92*	97½*
Amer. Pub. Serv., com.†	50	45*	80*
Amer. Pub. Utilities, 7% ptc. pf.	79	73*	89*
Amer. Pub. Utilities, 7% pr. pf.	90	86*	93*
Amer. Pub. Utilities, com.	m66	68*	82*
Amer. States Sec., A.	3½	2*	9½*
Amer. States Sec., B.	3½	1½*	5½*
Amer. Superpwr., $6 pf.—25	27½	26½	28½
Amer. Superpwr., 7% pf.	l 95	....	....
Amer. Superpwr., Class A†—no par.	28½	27½	29½
Amer. Superpwr., Class B†—no par.	29	28½	30
Amer. Wtr. Wks. & Elec., 7% pf.	k105½	105	110½
Amer. W. W. & E., com. $1.20—20.	67½	62½	67½
Anaconda Copper Cap. $3.	46½	45	49½
Appalachian Electric Pwr., 7% pf.	99	90*	101*
Appalachian Elec. Pwr., 2d pf., 7%	98	99*	102*
Appalachian Elec. Pwr., com.	m78	....	....
Arizona Pwr., 7% pf.	79	60*	82*
Arizona Pwr., com.	23½	22	24½
Arkansas Cent. Pwr., pf.—$7 no par	k101	99*	107*
Arkansas Lt. & Pwr., 7% pf.	102	99*	104*
Arkansas Lt. & Pwr., com.	100	110*	115*
Assoc. Gas & Elec., $3.50—50.	52½	....	....
Assoc. Gas & Elec., pf.—$6—no par.	87½	79½*	86½*
Assoc. G.&E., Class A, $2.50—no par	40½	35	41½
BABCOCK & WILCOX, 7% com.	116½	117*	151*
Binghamton L., H. & P., $6 pf.	91	90*	95*
Birmingham Elec., pf.—$7—no par.	106	101*	108*
Blackstone Valley G. & E., $6 pf.	102	103*	106*
Blackstone Valley Gas & Elec., 10% com.—50.	99½	98½	108
Blaw-Knox, com.†	l 70½	70	73
Brazilian Trac., Lt. & pwr., com.†	f117½	....	....
Broad River Pwr., 7% pf.	95	93*	98*
Brooklyn Edison, 8% com.	150½	148½	154½
Buffalo, Niagara & East. Pwr., pf.—25	l 25½	....	....
Buffalo, Niagara & East. Pwr. com.† —no par.	l 27½	....	....
CALIFORNIA ELEC. GENERATING, 6% pf.	96	89*	95*
California Ry. & Pwr., 7% pf.	120	88*	130*
Carolina Pwr. & Lt., pf.—$7—no par	f107½	107	108½
Central & S.W. Util., 7% pf.—no par	a 94½	93½	96½
Central & S.W. Util., pr. ln. $7 pf.—no par.	a100	98½	101½
Central Ariz. Lt. & Pwr., 7% pf.	94	....	....
Central Ark. Ry. & Lt., 7% pf.	101	99*	101*
Central Ill. Pub. Serv., 6% pf.	k 86	89*	91*
Central Ind. Pwr., 7% pf.	87	84½*	93½*
Central Pwr. Lt., 7% pf.	101½	94*	103½*
Central States Elec., 7% pf.	92	....	....
Central States Elec., com.†	m200	200*	230*
Century Elec., 6% com.	m117	110*	117*
Chicago Fuse Mfg., com.—$2.50 no par.	a 34½	30	34½
Cincinnati Gas & Elec., 5% com.	q 94½	93½	95½
Cities Service, 6% pf.	l 91½	91½	92½
Cities Service, pf. B—10.	l 8½	8½	8½
Cities Service, pf. BB—100.	l 84	82	84
Cities Service, com.—20.	l 58½	50½	58½
Cities Service, Bks. Shrs.—10.	l 29½	25	29½
Clarion River Pwr., 8% pf.	95	93*	95*
Cleveland Elec. Illu., 6% pf.	108	103*	109*
Cleveland Elec. Illu., 10% com.	300	240*	310*
Colorado Pwr., 7% pf.	k 95	96*	97*
Columbia Gas & Elec., 6% pf.	101	99½	101½
Columbia G. & E. com. $5—no par.	85½	82½	91½
Columbia Ry., Gas & Elec., 6% pf.	94	65*	96*
Columbus Elec. & Pwr., 2d. pf.	103	....	....
Columbus Elec. & Pwr., 9% com.	55	....	....
Columbus Ry., Pwr. & Lt., 6% 1st pf.	99	98*	99½*
Columbus Ry., Pwr. & Lt., 6½% pf. B	106	....	....
Columbus Ry., P. & L., com.—no par	67½	70*	85*
Commonwealth Edison, 8% com.	a141	138	141
Commonwealth Pwr., 6% pf.	93½	91½	93½
Commonw'th Pwr., $2, com.—no par	44	42½	45
Conn. Lt. & Pwr., 8% pf.	118	117*	121*
Conn. Lt. & Pwr., 7% pf.	112	108*	113*
Cons. Gas of N. Y., pf.†—50.	55½	57*	62½*
Cons. Gas of N. Y., com $5—no par.	100½	97½	109½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6% pf.	a107½	106½	107½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½% pf.	a111½	111	111½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 7% pf.	a115	113½	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti., 8% pf.	a128	126	128
Cons. Gas, Elec. Lt. & Pwr. of Balti., com. $2.50—no par.	e 51½	51	52
Consolidated Pwr. & Lt., 7% pf.	106	100*	107*
Consumers Pwr., 6% pf.	101	95*	101½*
Consumers Pwr., 6.6% pf.	104½	101½*	106*
Continental Gas & Elec., 7% ptc. pf.	105	96*	109½*
Continental Gas & Elec., 7% pr. pf.	102	95½*	101½*
Conti. G. & E. com. $4.40—no par.	k210	85*	210*
Crocker Wheeler, com.†	35½	....	....
Crocker Wheeler, 7% pf.	84	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	102	95*	100*
Detroit Edison, 8% com.	k136½	133½	136½
Dubilier Condenser, com.—no par.	k 3½	3½	4
Dubuque Elec., 6% pf.	103	93*	98½*
Duquesne Lt., 7% pf.	k115	114½	116½
EASTERN NEW YORK UTIL., $7 pf.	102	80*	104*
Eastern New York Util. com.	65	70*	75*
Eastern States Pwr., $7, com.	11	12*	32½*
Eastern States Pwr., pf.	93	89*	95*
East. Tex. Elec., 7% pf.	106	100*	107*
East. Tex. Elec. com. $5—no par.	90	70*	80*
Edison Elec. of Boston, 12% com.	d218	217	229½
El Paso Elec., com. $5—no par.	70	70*	94*
El Paso Elec., 7% pf.	106	102*	106½*
Elec. Bond & Share, 6% pf.	k107½	107½	109
Elec. Bd. & Sh. Sec., com. $1—no par	l 68½	67½	72½
Electric Household Util.†	a 14½	11	14½
Elec. Investors, 6% pf.—no par.	92	87*	95*
Elec. Investors, com.†—no par.	33½	32½	37
Elec. Investors, 10% pd. receipts.	15	12*	56*
Elec. Pwr. & Lt., ctfs. pf.	97½	96	97½
Elec. Pwr. & Lt., ctfs., 40% pd.	k104½	103½	104½
Elec. Pwr. & Lt., ctfs, full pd.	k104½	102½*	110½*
Elec. Pwr. & Lt., ctfs., com.—no par.	18½	16½	18½
Elec. Refrig. cap.†	34½	30½	37½
Elec. Ry. Securities, com.—no par.	m 8	....	....
Elec. St. Battery com. $5.25—no par	k 76	72½	79½
Elmira Wtr., Lt. & R.R., 7% pf.	.100	97½*	101½*
Emerson Elec., pf.	m105	101*	105*
Empire Pwr., A $6.	26	....	....
Engr. Pub. Serv., $7 pf.—no par.	m 99	93½	99
Engr. Pub. Serv., com. $7—no par.	23½	21½	24½
Eureka Vacuum Cleaner, com. $4—no par.	62½	60½	67½
FAIRBANKS MORSE, 7% pf.	k108	107½	110
F.-M., com.—$2.60—no par.	40½	38½	42½
Federal Lt. & Trac., com.†	42½	37½	42½
Federal Lt. & Trac., 5% pf.	k 93½	92½	95
Ft. Worth Pwr. & Lt., 7% pf.	d108½	108	112
GALVESTON-HOUSTON ELEC. 6% pf.	70	65*	70*
Galveston-Houston Elec., com.	26½	....	....
Gen. Elec., 8% com.	86½	81	86½
Gen. Elec., special—10.	11½	11½	11½
Gen. Gas & Elec. (Del.) com. A. $1.50—no par	45½	40½	45½
Gen. G.&E. (Del.) com. B—no par.	m 42	36*	48½*
Gen. G.&E. (Del.) pf. A. $8—no par.	k114	115	115½
Gen. G.&E. (Del.) pf. A $7—no par.	k102½	106	107
Gen G & E. (Del.) pf. B $7.	k 97	96	98½
Gen. Pub. Serv., $7 pf.	k103	102*	106*
Gen. Pub. Serv., com.	13	11½	14½
Ga. Lt., Pwr. & Rys., 6% pf.	90	82*	98*
Ga. Lt., Pwr., & Rys., com.	m 60	65*	80*
Ga. Ry. & Pwr., 8% pf.	k120	112*	122*
Ga. Ry. & Pwr., 7% pf.	106½	100½*	108*
Ga. Ry. & Pwr., 4% pf.	m119	....	....
Ga. Ry. & Pwr., 4% com.	120	....	....
Gt. Western Pwr., 7% pf.	k103	....	....
IDAHO PWR., 7% pf.	103½	103*	106*
Ill. No. Utilities, 6% pf.	99½	....	....
Ill. Pwr. & Lt., 7% pf.	k 99½	96½	100
Ingersoll Rand com. $8.	k 92½	92	95½
Int. Combus. Engr., com. $2—no par	56½	43½	56½
Int. Util., Class A—$3.50—no par.	30½	28	31½
Int. Utilities, Class B—no par.	4	3	5½
Interstate Pwr., pf.—$7—no par.	94	90*	98*
Interstate Pub. Serv., 7% pf.	99	96½*	99½*
Iowa Ry. & Lt., 7% pf.	96	98*	100*
JERSEY CENTRAL PWR. & LT., 7% pf.	98	94*	98½*
Jersey Cent. Pwr. & Lt., 7% ptc. pf.	113	95½*	112*
Jersey Cen. Pwr. & Lt., com.—no par	k 25	25*	50*
Johns-Manville, com.†—no par.	61½	55½	66

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 19. lBid price Wednesday, Feb. 23. mLatest quotations available. *1926. †Dividend rate variable.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Monday Feb. 21	Low 1927	High 1927
KANSAS CITY PWR. & LT. pf.$7	113	112	114¼
Kansas Gas & Elec., 7% pf.	/104	103	104
Kentucky Hydro-Elec., 7% pf.	a 97½	94½	97½
Kentucky Sec.,6% pf.	85	75*	85*
Kentucky Sec., 5% com.	107	90*	108*
Kentucky Utilities, 6% pf.	95	92	97
Keystone Pwr. & Lt., 7% pf.	97	95*	98½*
LACLEDE GAS LT., 8% com.	184½	173½	184½
Lehigh Pwr. Sec., com.—no par.	17	15½	18
Long Island Ltg., 7% pf.	107½	....	....
Long Island Ltg., com. $2—no par.	140	120	145
Los Angeles Gas & Elec., 6% pf.	99	95½*	100*
Louisville Gas & Elec., cl. A. $1.75	25½	25½	32½
MAN. ELEC. SUPPLY, cap. $4.25 —no par.	58½	53½	60
Manila Elec., com.†—no par.	k 40	40	44
Maytag Mfg., com. .50—no par.	27	23½	28
Memphis P. & L., pf.—$7—no par	107½	103*	110*
Metropolitan Ed., pf.—$6—no par.	95	91½*	98*
Metropolitan Ed., pf.—$7—no par.	104	102*	108*
Metropolitan Ed., com. $5—no par.	60	45	60
Middle West Utilities, 7% pf.	a109½	105½	113½
Middle West Util., 7% pr. lien pf.	a119	117½	119½
Middle West Util., com. $6—no par	a111½	110	114½
Midland Utilities, pr. ln. 7% pf.	a102	98	102
Midland Utilities, 7% pf. A	a 99½	97	99½
Milwaukee Elec. Ry. & Lt., 7% pf.	k100	100*	103*
Milwaukee Elec. Ry. & Lt., 6% pf.	k 98½	87*	100*
Minn. Pwr. & Lt., 7% pf.	/104½	104	105
Miss. Pwr. & Lt., $8 pf.	108	102*	107½*
Miss. River Pwr., 6% pf.	96	93*	96*
Miss. River Pwr., com.	m 62	....	....
Mohawk Hudson Pwr., 1st pf.—$7 —no par.	101	....	....
Mohawk Hudson Pwr., 2d pf.—$7 —no par.	99	90*	102*
Mohawk Hudson Pwr., com.—no par	25½	20½	27
Montana Pwr., 7% pf.	119½	118½	119½
Montana Pwr., 4% com.	87½	81½	87½
Montreal Pwr., 7% com.	f 73½	....	....
Mountain States Pwr., 7% pf.	99	97*	102*
Mountain States pwr., com.†	18	....	....
NASSAU & SUFFOLK LTG., 7% pf.	99½	93*	101*
National Carbon, 8% pf.	m130	124*	130*
National Elec. Pwr., A†	24½	23½	25½
National Elec. Pwr., 7% pf.	a 96	93½	96
National Lt., Ht. & Pwr., com.	24	22*	25*
National, Light, Ht. & Pwr., 5% pf.	70	71*	73*
National Pwr. & Lt., pf.—$7—no par	102	101½	103
National Pwr. & Lt., com.†—no par.	20½	19½	22
National Pub. Serv., 7% pf.	k 94½	87½*	95*
National Pub. Serv., 7% pfc., pf.	111	96*	112*
National Pub. Serv., A com. $1.60— no par.	21½	18½	21½
National Pub. Serv., B com.—no par	k 16	14	16½
Nebraska Pwr., 7% pf.	/106	106	108½
Nevada-Calif. Elec., com.	m 25	25	26½
New Brunswick Pwr., 7% pf.	55	30*	60*
New Eng. Pub. Serv., pr. ln. pf. $7..	99½	98*	101*
New Eng. Pub. Serv., pf. $7	95	95½*	97*
New Orleans Pub. Serv.—7% pf.	k103½	100*	105*
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	80*	95*
N. Y. Central Elec., 7% pf.	102	98*	100*
Newport News & Hampton Ry., Gas & Elec., 5% com.	109	98*	112*
Newport News & Hampton Ry., Gas & Elec., 7% pf.	109	98*	114*
Niagara Falls Pwr., 7% pf.—25.	28½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	111	110*	111½*
No. Amer., 6% pf.—50.	50½	50	51½
No. Amer., com.—10.	49½	45½	49½
No. Amer. Edison, $6 pf.—no par.	k 98½	96½	100½
No. Caro. Pub. Serv., pf.—$7—no par	95	89*	96*
Northeastern Pwr., com.	17½	16½	18½
No. Indiana Gas & Elec., 7% pf. A.	101	98*	103½*
No. N. Y. Utilities, 7% pf.	104	103	105½
No. Ohio Pwr., com.—no par.	11½	9½	12½
No. Ohio Trac. & Lt., 6% pf.	80	78*	81*
No. Ohio Trac. & Lt., 7% pf.	90	88*	96*
No. Ont. Lt. & Pwr., 6% pf.	k 87	75*	88½*
No. Ont. Lt. & Pwr., 4% com.	74	73*	78*
No. States Pwr., (Del.) 7% pf.	103	101½	103
No. States Pwr., (Del.) 8% com.	112½	109½	113½
No. Texas Elec., 6% pf.	74	48*	65*
No. Texas Elec., 4% com.	34½	27	31
OHIO BRASS, com. B $4—no par.	76	70*	80*
Ohio Brass, 6% pf.	100	98*	101*
Ohio Gas & Elec., 7% pf.	95	90*	95*
Ohio Pwr., 6% pf.	97½	90*	97*
Ohio Pub. Serv., 6% pf.	/95	94½	95
Ohio Pub. Serv., 7% pf.	/105	103½	105
Ohio River Edison, 7% pf.	104½	98½*	105*
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf.	l 31½	31	33
Pacific Gas & Elec., 8% new com.	k 31½	31	33
Pacific Pwr. & Lt., 7% pf.	/103	102	104
Parr Shoals Pwr., 6% pf.	92	90*	97½*
Penn Cent. Lt. & Pwr., $5 pf.—no par.	c 73	71½	73
Penn-Ohio Edison, 6% pf.	80½	80½	82
Penn-Ohio Elec., 7% pf.	95	93*	96*
Penn-Ohio Pwr. & Lt., 7% pf.	100	94*	100*
Penn-Ohio Pwr. & Lt., 8% pf.	110	100*	111*
Penn Pwr. & Lt.—$7—no par.	/108	107	108½
Penn Pub. Serv., 6% pf.	87	85*	90*
Penn Wtr. & Pwr., 6% com.	a183	176	185
Phila. Co., 6% pf.—50.	k 51	50	53
Phila. Co., com.—50.	k 85	85½	88
Phila. Elec., 8% com.—25.	c 47½	....	....
Portland Elec. Pwr., 7% pf.	97½	97*	101*
Portland Elec. Pwr., 6% pf.	81	71*	87*
Portland Elec. Pwr., 6% 2d pf.	68	71*	75*
Portland Elec. Pwr., com.	26	26*	48*
Potomac Elec. Pwr., pf.	/108½	....	....
Pwr. Corp. of N. Y., com. $1—no par	m79	77½*	90½*
Pwr. Sec., pf.—no par.	k 30	10*	30*
Pwr. Sec., com.—no par.	k 5	4*	13*
Public Serv. of Colorado, 7% pf.	l 99	99	99
Pub. Serv. of N. J., 7% pf.	109½	108½	110½
Pub. Serv. of N. J., 8% pf.	k126½	125	126½
P. S. of N. J., $5 com.—no par.	34½	32	35
Pub. Serv. of No. Ill., 6% pf.	a103½	102	105
P. S. of No. Ill., com. $8—no par.	a135	130½	136
Pub. Serv. of No. Ill., 8% com.	a135	132	136
Pub. Serv. of Okla., 7% pf.	99	92*	100*
Pub. Serv. Elec. & Gas, 6% pf.	104½	102	104½
Pub. Serv. Elec. Pwr., 7% pf.	115	113½	115
Puget Sound Pwr. & Lt., 7% pf.	105	103*	108*
Puget Sound Pwr. & Lt., 6% pf.	84	82*	84½*
Puget Sound Pwr. & Lt., com.	31	....	....
RADIO CORP. OF AMER., pf.—50	52	50½	52½
Radio Corp. of Amer., com.—no par.	k52½	47½	56½
Republic Ry. & Lt., pf.	k118	95*	120*
Republic Ry. & Lt., com.	120	75*	116*
Rochester Gas & Elec., 6% pf. D.	k 101½	98*	102*
Rochester Gas & Elec. 6% pf. C.	101½	....	....
Rochester Gas & Elec., 7% pf.	106	105*	107*
SAFETY CABLE, com. $4	58½	52½	59½
San Joaquin Lt. & Pwr., 7% pf.	106	97½*	108*
St. Joseph Ry., L., H. & P., 5% pf.	70	60*	70*
Servel Corp.	9½	7½	9½
Sierra Pacific Elec., com.	24	....	....
Sioux City Gas & Elec., 7% pf.	99	96*	101½*
Southeastern Pwr. & Lt., pf.—$7 no par.	/102½	....	....
Southeastern Pwr. & Lt., $6 pfc. pf.	l 69½	....	....
Southeastern Pwr. & Lt., com.—no par.	30½	30	32½
So. Calif. Edison, 8% pf.	36½	32½*	36*
So. Calif. Edison, 7% pf.	27	....	....
So. Calif. Edison, 6% pf.	24½	24½*	25½*
So. Calif. Edison, 8% com.	34	31½	34½
Southern Cities Utilities, 7% pf.	83	....	....
Southern Cities Utilities, com. $4.	25	....	....
Southwestern Lt. & Pwr., A $3.	63	52*	60*
Southwestern Lt. & Pwr., B.	60	38*	58*
Southwestern Lt. & Pwr., $6 pf.	85	78*	82*
Southwestern Pwr. & Lt., 7% pf.	k105	100*	105*
Springfield (Mo.) Ry. & Lt., 7% pf.	97	95*	100*
Standard Gas & Elec., 8% pf.	59	57½	60
Standard Gas & Elec., 7% pf.	105½	....	....
Standard G. & E., com. $3—no par.	55½	54	55½
Standard Pwr. & Lt., 7% pf.	96	90*	98½*
Staten Island Edison, pf.—$6—no par.	98	93*	97½*
Superheater, $6 com.—no par.	172	138*	173*
Syracuse Lighting, 7% pf.	102	105*	107*
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, 8% com.	300	260*	355*
TAMPA ELEC., com. $2	58½	49	62½
Tenn. Elec. Pwr., 6% pf.	90½	87*	90*
Tenn. Elec. Pwr., 7% pf.	102½	98*	105*
Terre Haute, Ind. & East. Trac., 5% pf.	20	20*	37*
Terre Haute, Ind. & East. Trac., com	1	1*	7*
Tex. Pwr. & Lt., 7% pf.	/106½	106	108
Tide Water Pwr., 8% pf.	106	101*	106*
Timken Roller Bear., com.—$4 no par.	92	78	95½
Toledo Edison, 8% pf.	/115	114	115
Toledo Edison, 7% pf.	/105½	104	105½
Toledo Edison, 6% pf.	l 95	94½	95
Toledo Edison, 6% com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	96	87½	90
UNITED GAS & ELEC., 6% pf.	98	94*	97*
United Gas & Elec., com.—no par.	m57	56*	66*
United Gas & Elec. (N. J.) 5% pf.	70	70*	75*
United Gas Impr., 8% com.—50.	c 90½	....	....
United Lt. & Pwr., pf.—$4—no par.	51	44*	53*
United Lt. & Pwr., pf.—$6.50—no par.	91½	87	93
United L. & P., com. A .48—no par.	13	12½	15½
United L. & P., com. B .48—no par.	k 16	13	29
Utah Pwr. & Lt., 7% pf.	/105	104	105
Utica Gas & Elec., 7% pf.	105	103*	106*
Utica Gas & Elec., 8% com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	93	92*	98*
Utilities Pwr. & Lt., com. A $2.	29	27	29½
Utilities Pwr. & Lt., com. B $1—no par.	14½	13½	15½
VERMONT HYDRO-ELEC., 7% pf.	96	94*	96*
Virginia Elec. & Pwr., 7% pf.	106	101*	105*
Virginian Pwr., 7% pf.	108	102*	104*
Virginian Pwr., com.	70	65*	75*
WAGNER ELEC., 7% pf.	b 69	68	74
Wagner Elec., com.†—no par.	m 20½	18½	24
Washington Ry. & Elec., 5% com.	/210	....	....
Washington Ry. & Elec., 5% pf.	/ 91	....	....
Washington Wtr. Pwr., 8% com.	136	130*	138*
West Mo. Pwr., 7% pf.	m92	....	....
West Penn Elec., 7% pf.	106	102	107½
West Penn Elec., Cl. A $7.	k102½	97½	103
West Penn Pwr., 7% pf.	112½	111	114
West Penn Pwr., 6% pf.	102	100½	103
West Virginia Lt., Ht. & Pwr., 7% pf.	93	95*	98*
West Va. Utilities, 7% pf.—50.	49½	43*	51*
Western Pwr., 7% pf.	90	98	101
Western States Gas & Elec., 7% pf.	92	89*	94½*
Western States Gas & Elec., com.	10	....	....
Westinghouse Elec. & Mfg., 8% com. —50.	74½	67½	74½
Weston Elec. Instrument, Cl. A $2.01 —no par.	k 33½	30½	34½
Weston Elec. Instrument, com.—no par.	18	15	18½
Wheeling Elec., 6% pf.	93	91*	97*
Wis., Pwr., Lt. & Ht., 7% pf.	k 95	85*	91*
Worthington Pump, 7% pf. A.	k 48	46	50
Worthington Pump, 6% B.	k 41½	40	43½
Worthington Pump, com.	26	20½	27
YALE & TOWNE com. $5—25.	k 73½	70½	73½

Stock Exchange: gChicago; hSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid price Saturday, Feb. 19. lBid price Wednesday, Feb. 23. mLatest quotations available. *1926. †Dividend rate variable.

subsidiary of the Ottawa & Hull Power Company, Ltd., covers a period of ten months and shows gross revenue of $274,953, sufficient to meet all expenses, taxes and interest charges, to provide a substantial reserve for depreciation and leave a small balance to be carried forward as surplus.

Standard Power Redemption in April.—The Standard Power & Light Corporation, successor to the Pittsburgh Utilities Corporation, has called for redemption April 18 the issue of $10,000,000 two-year 5 per cent first lien gold notes of the Pittsburgh Utilities Corporation dated April 15, 1926, at 100½ and interest.

Barstow Association Organizes Industrial Development Division.—The W. S. Barstow Management Association, Inc., New York, operator of the General Gas & Electric Corporation public utilities, has organized an industrial development division under the direction of E. D. Philbrick. The new division will assist in their industrial expansion many of the leading cities in North and South Carolina and Florida which are served by the companies owned by the General Gas & Electric Company. Mr. Philbrick, who will direct the division, is well known in the South, especially to civic organizations with which he has worked closely for several years.

Annual Report of Ottawa & Hull Power Company.—Further satisfactory growth is reflected in the third annual report of the Ottawa & Hull Power Company Ltd., of Ottawa, Ontario, covering a period of fourteen months ended Oct. 31, 1926. Gross revenue for the fourteen months amounted to $446,540, equivalent to an annual rate of $382,748, as compared with $367,610 in the twelve months ended Aug. 31, 1926.

Indiana Utility Petitions Commission.—The Indiana Service Corporation of Fort Wayne, in a petition just filed with the Indiana Public Service Commission, has asked to increase by 30,500 the number of shares of its preferred stock and by 200,000 the common-stock shares in order to reimburse the company for betterments and extensions for 1926 and those planned for 1927. The petition states that the present authorized stock is 40,000 shares of preferred, with a par value of $100, and 500,000 shares of common.

Jersey Commission Approves Issuance of Securities.—Issuance by the Public Service Electric & Gas Company, Newark, N. J., of stock and bonds totaling $25,000,000 was approved Feb. 19 by the Board of Public Utility Commissioners. The money will be used to buy the Public Service Electric Power Company. The securities will consist

of $18,712,000 first and refunding mortgage gold bonds, 5 per cent series, due in 1965; $4,173,600 in 6 per cent cumulative preferred stock, 1925 series, and 300,000 shares of common stock without par value.

Middle West Utilities Plans Changes in Set-up

The annual meeting of the stockholders of the Middle West Utilities Company has been called for March 29, when an amendment to the company's charter of incorporation will be submitted to the stockholders.

The amendment provides for the creation of no-par-value preferred and prior lien stocks in addition to the present prior lien and preferred stocks of $100 par value. It is proposed that these no-par prior lien and preferred stocks be authorized for issuance in seven series varying in interest rates from $5 to $8. Two hundred and fifty thousand shares of the prior lien stock without par value and 250,000 shares of preferred without par value are proposed for authorization. The proposed amendment also increases the authorized prior lien and preferred stocks of $100 par value from $50,000,000 each to $70,000,000 each. In its notice to the stockholders the company points out that the proposed amendment is for the purpose of enabling the company in financing expansion to issue stock of varying dividend rates as conditions dictate.

Republic Railway & Light to Dissolve.—At a special meeting held Feb. 15 stockholders of the Republic Railway & Light Company approved a plan for the dissolution of the company, to become effective March 1. At the annual meeting which preceded the special meeting the stockholders elected as directors Henry L. Bogert, Jr., H. A. Clarke, Herbert L. Dillon, Clarence L. Harper, John C. Harrington, Alfred L. Loomis, John H. Pardee, R. P. Stevens and Landon K. Thorne, who will become liquidating trustees, when dissolution of the company becomes effective.

Recent Listings.—The New York Stock Exchange has authorized the listing of $8,000,000 of additional first and refunding mortgage gold bonds, series B, of the New Orleans Public Service, Inc., making the total amount of such series B 5 per cent bonds due June 1, 1955, applied for $13,000,000. Additional common stock of the Pacific Gas & Electric Company has been authorized for listing by the New York Stock Exchange to the amount of $5,287,000, making the total amount of common stock applied for $58,232,800. Sinking-fund mortgage gold bonds to the amount of $1,000,000 of the Silesia Electric Corporation (Elektrizitätswerk Schlesien Aktiengesellschaft) were authorized for listing by the New York Stock Exchange. Authority was included to admit to the list $3,000,000 additional upon official notice of issuance in exchange for outstanding interim receipts, making the total amount applied for $4,000,000.

Quebec Power to Increase Issued Capital Stock.—The Quebec Power Company is to increase its issued capital stock to $10,000,000 by offering to its shareholders at par three new shares for every ten shares held. The new shares will be paid for in two installments in May and June, and the new stock will rank for dividends for the quarter beginning July 1 next. Another important development in the company is the declaration of a quarterly dividend of 1¾ per cent for the current quarter. This places the stock on a 7 per cent basis as compared with a 6 per cent rate which existed up to the end of 1926.

Hartford Stockholders Vote Stock Increase.—Stockholders of the Hartford Electric Light Company increased the authorized capital stock Feb. 8 from $16,000,000 to $20,000,000, par $100. At the present time the company has a bill pending in the General Assembly at Hartford to amend its charter in relation to capital, making the limit $30,000,000.

Brooklyn Edison Shows Rapid Growth

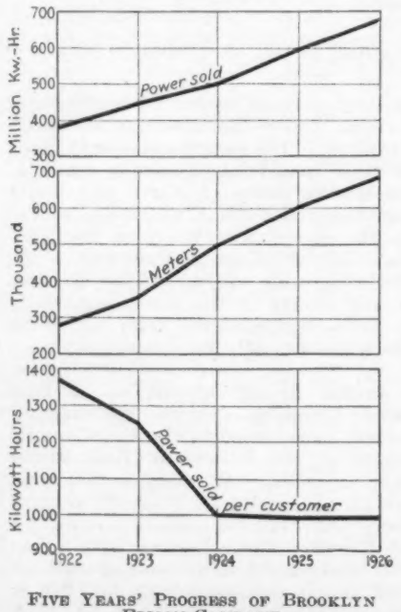
Net Increase in Surplus of This Company Is 33.4 per Cent Greater than Last Year—Net Revenue Up 22.8 Per Cent—Number of Meters Added Up 13 Per Cent

INCREASE in gross revenues of the Brooklyn Edison Company in 1926 was sufficiently greater than the growth in operating costs to allow for a 22.3 per cent rise in net income. Outstanding features of the company's remarkable record of expansion are shown in the tabulation which follows:

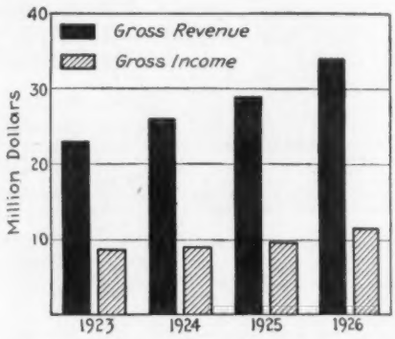
	1925	1926	Gain	Per Cent Gain
Gross	$29,791,800	$34,020,871	$4,229,071	14.2
Net	7,404,882	9,097,925	1,703,572	22.8
Meters	601,257	684,454	83,197	13.8
Output, kw.-hr.	594,576,980	674,741,645	80,164,665	13.5
Addition to surplus	1,530,097	2,042,077	511,998	33.4
Income for dividends	9,097,025	7,404,882	1,693,043	22.9

While last year's figures do not constitute a record in growth for the company, the increase is in line with that of previous years. During the past five years annual percentage increases in the factors shown above were:

	1922	1923	1924	1925	1926
Gross	16.9	20.2	12.5	15	14.2
Net	48	39	23.6	4.9	22.8
Meters	26.4	28	39	20.5	13.9
Output	17	16.7	12.5	18.8	13.5



FIVE YEARS' PROGRESS OF BROOKLYN EDISON COMPANY



REVENUE AND INCOME RECORD OF PAST FOUR YEARS

Earnings on the shares of stock outstanding are the largest since 1923, being $12.13 against $10 for 1925.

The financial set-up of the company shows the smallest proportion of obligations for a considerable period. Indebtedness now constitutes only 37.5 per cent of fixed capital against 38, 44, 42 and 53 per cent for the previous five years respectively. It was indicated by President Sloan that the question of new financing would soon be raised to take care of the large construction program necessary to meet rapidly growing market needs, and, as reported elsewhere, a stockholders' meeting has been called for Feb. 28.

Additions to generating equipment last year increased plant capacity from 339,500 kw. in 1925 to 419,500 kw. Gross revenue per kilowatt-hour sold in 1926 was 5.07 cents against 5.03 cents the previous year. Net revenue per kilowatt-hour was 1.7 cents for each of the past two years.

Canadian Company Issues Bonds.—First mortgage sinking-fund 6½ per cent 20-year bonds of the Lake St. John Power & Paper Company, Ltd., a Quebec company, have been issued at 99½ and interest. These bonds will be secured by a specific first charge on real and immovable property of the company, including a mill now under construction, timber leases and power sites and a floating charge on all other assets of the company. Proceeds will be used entirely for the construction of the mill, payment for properties and for working capital.

Manufacturing and Markets

No 1927 Electrical Code to Be Published

Committee Recommends Many Rules for Field Trial and Will Consider Adoption in 1928

AT THE 1927 annual meeting of the electrical committee of the National Fire Protection Association, held last week, it was decided not to print a 1927 code. Many proposed changes, while deemed by the committee to be proper and desirable, were recommended for field trial, but their use has not been made mandatory by adoption. The mass of new rules, while reasonably well studied and considered, was believed by the committee not to have been sufficiently compared for conflict; but as it was desirable to offer many of the rules for field trial, the committee so recommended. Among these rules may be mentioned the motor-wiring rules. All items now included in the National Electrical Safety Code and which are not controversial have been receiving the study of the committee on safety and will probably appear in the next fire code. Many of the reports of sub-committees were treated as progress reports. All but two of the regular members attended the meeting.

It was decided by the committee that in future when any sub-committee shall reject a rule it will have to be reported. The subject of limiting the number of lighting circuits in a given area was discussed, but no definite action was taken. A progress report was presented on the grounding of portable devices, and the committee studying this subject was requested first to dispose of the recommended practice for industrial plants before considering their use in the home, in order to expedite action and obtain results where most needed. One of the questions now being considered covers the general problem where alternating current is superseding direct current in congested areas and transformers under the jurisdiction of the power company are being placed in the customers' premises. It is interesting to note that the committee has dropped the rules for series arc lighting as the need for them has long since passed.

Interpretation Procedure

The report of a special committee on interpretations, of which A. R. Small is chairman, was unanimously adopted and will become effective immediately. The other committee members are Messrs. Blood, Coggeshall, Forsyth and Sargent. The report says:

The February, 1926, meeting having rejected the special committee's recommendation that no further consideration be given to a plan for interpretations of the provisions of the National Electrical Code, and having instructed the special committee to present a plan for an interpretation procedure, if possible, to the 1927 meeting, the special committee submits the following and recommends formal adoption of the procedure described:

The executive committee of the sponsor organization, having been apprised of this project, voted on Jan. 15, 1927, to authorize the electrical committee to set up an interpretation procedure along lines which it judged advisable. The special committee recommends the appointment of a special standing committee of the electrical committee organization, to be known as the "interpretations committee." This committee to consist of:

The chairman of the electrical committee, ex officio, who shall be the chairman of the interpretations committee; the electrical field secretary, ex officio, who shall be the secretary of the interpretations committee; the chairman of that article committee which has charge of that paragraph or section of the code for which an interpretation is requested, and at least two other members or alternates of the regular electrical committee personnel.

In other words, the entire personnel to constitute a panel from which the chairman may draw, depending upon availability, experience, knowledge, and interest (provided, however, that no member or alternate shall be eligible who is actually concerned with a controversial situation to which the specific question of interpretation applies).

Those desiring an interpretation shall supply the chairman with five identical copies of a statement in which shall appear specific reference to a single problem, paragraph or section. Such a statement shall be on the business stationery of the inquirer and shall be duly signed. It is expected that when queries involve actual situations they will so state and that all parties concerned will be named.

Two general forms of findings will be recognized, (a) those making an interpretation of the literal text; (b) those making an interpretation of the intent of the electrical committee when a particular rule was adopted.

The findings of the interpretations committee will be in its name and for the electrical committee as a whole. The party seeking the inquiry will be informed of the finding promptly, following its having been determined. From time to time these findings, serially numbered but not otherwise identified, will be bulletined to the electrical committee mailing list, including the technical press.

The interpretations committee personnel serves as volunteers and will endeavor to follow businesslike methods for expediting the disposing of its docket. It cannot be responsible for it coming to pass that authorities enforcing the National Electrical Code or other electrical wiring regulations decline to acquiesce in or otherwise recognize the findings.

Each article committee will be expected to give appropriate consideration to the text of any section or paragraph which has produced an interpretation finding to the end that suitable revision of the text may be brought about, if called for.

It is further recommended that the technical press be requested to give appropriate publicity to the foregoing program and that it be declared immediately in effect.

Capitalizing Good Will in an Appliance Sales Contract

AN INTERESTING form of contract has lately been put into effect between the Narragansett Electric Lighting Company of Providence, R. I., and several electric appliance manufacturers under the terms of which the former capitalizes its prestige with the public in its territory as a factor in sales stimulation helpful to the manufacturer. In brief, the contract provides that in return for exclusive sales privileges in the Narragansett company's electric stores and for the co-operation of the central-station company in various ways, the manufacturer supplies the necessary trained sales forces, cares for servicing and the stocking of his electric appliances and pays the lighting company a stated commission on sales of his products in the utility territory, guaranteeing a minimum sum to the lighting company on a monthly settlement basis.*

This contract was drawn as an outcome of many years of experience in electrical merchandising by the Narragansett company, during which the management has been increasingly convinced of the wisdom of doing everything in reason to make merchandising operations profitable. In its prestige with the public the company has an asset of great value, not only to itself but to appliance manufacturers. Believing that this asset has a money value the company negotiated the contract. A résumé of some of the more important provisions is given below:

Important Contract Provisions

Four stores of the company in Providence and five in the outlying territory are listed in the agreement. All electric shops of Narragansett subsidiary companies automatically become contract stores, and it is agreed that the Narragansett company may at any time establish additional stores or discontinue any store except its main electric shop in the Turks Head Building, Providence. The Narragansett company agrees that during the life of the contract it will not allow any person or company other than the manufacturer to sell his equipment in any of its stores, or under its name or in its behalf, and the manufacturer agrees not to sell his product in the Narragansett territory except through the Narragansett company unless in each particular case the Narragansett company has refused for any reason to accept such sale.

Under this contract the manufacturer agrees to employ at his own expense all persons necessary or convenient for the proper demonstration and selling of his product in the main store, for window displays in the branch stores, and

*The _____ Manufacturing Company agrees to pay the Narragansett Electric Lighting Company (—) per cent of the retail price of the former's appliances sold in the territory of the Narragansett Electric Lighting Company, and further agrees that its total payment for any period consisting of one or more months shall be not less than the greater of the amounts arrived at as follows: (a) By multiplying one-twelfth of the annual guarantee in dollars by a number equal to the number of months contained in such period; (b) by multiplying the retail price of all appliances sold during such period by (—) per cent, due allowance being made for repossessed appliances.

also all persons needed for the handling of such equipment in the contract stores and to the purchasers of such equipment. Delivery facilities may be contracted for by the manufacturer, however, with the consent of the power company. An important provision is that the operating personnel of the manufacturer's local set-up shall at all times consist of persons skilled in the demonstration of his product and competent to build up and maintain cordial relations between the utility company and the public. The manufacturer agrees to remove from his personnel any one unsatisfactory to the Narragansett company when requested to do so.

All appliances sold for cash must be marketed at the regular retail selling price of such devices as fixed by the manufacturer thereof. All equipment sold on any time payment plan is marketed at a price over and above the retail selling price equal to a stated fractional percentage of such retail price times the number of months in which time payments are to be made. The maximum time payment allowance covers 24 months. As for employees of the power company, it is agreed that the price of all equipment sold on a cash basis shall be the retail price less the amount of commission ordinarily paid to salesmen of the manufacturer plus such part of the Narragansett company's commission as the latter shall determine. A percentage is added to the foregoing price in case of employee time payments. Such machines can be purchased on these terms for themselves or for their household relatives' use, and in no case may there be a resale.

The Narragansett company bills its customers for all appliances sold to them on its regular bill forms and on such terms as may be designated by the manufacturer subject to the limitations above outlined. The power company uses its regular methods of collecting and agrees to reimburse the manufacturer the amount of his loss in uncollectible accounts in excess of one-half of 1 per cent of the total sales made under the contract. The manufacturer agrees to furnish for each of the contract stores proper demonstration equipment and to carry in convenient stock a reasonable number of appliances to meet the requirements of Narragansett customers.

In putting a typical contract into effect the manufacturer agreed to purchase within three weeks of the contract date all appliances of his make which were then owned by the power company, and at a fair price. The manufacturer agrees to receive back from the customer purchasing the same any defective appliances which, considering all the circumstances, the Narragansett company agrees the customer has reasonable cause to return, and to authorize the power company to issue reasonable credit therefor. The manufacturer agrees upon receiving back any appliances for any reason whatever to credit the Narragansett company the amount paid therefor minus any amounts received from the customer and not credited as above set forth, but not including any sums received by the Narragansett company in respect to time payments. Monthly settlements are made between the two companies on retail sales made under this co-operative plan.

In its main store the Narragansett company agrees to furnish proper space for display and demonstration for window exhibits during the term of the contract. A maximum area is specified which the lighting company need not exceed in both main and branch stores. The manufacturer agrees to be responsible for and to replace all defective parts and to do all servicing of his product for one year after purchase and to make all adjustments which may be necessary for 90 days without cost to the Narragansett company or to the purchaser of the appliances.

January's Production Under December's

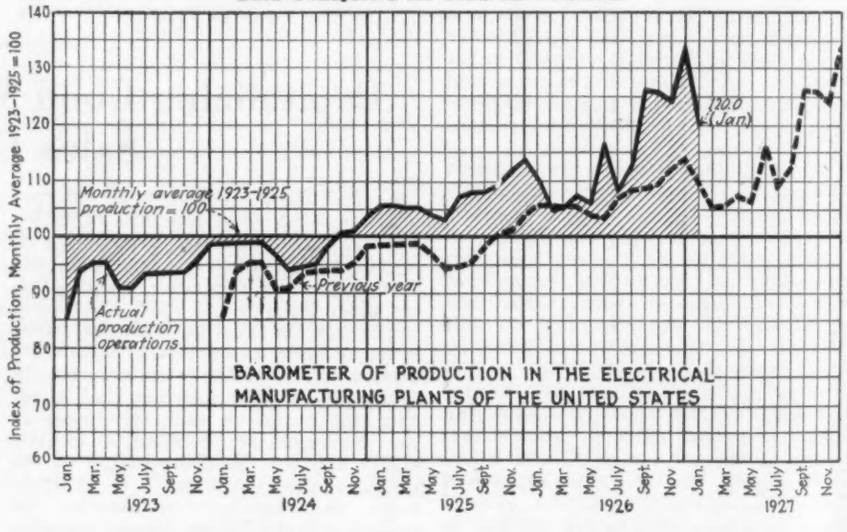
Electrical Manufacturing Plants Report Operations in First Month of 1927 5.3 Per Cent Under Preceding Month but 8.6 Per Cent Above January, 1926

REPORTS of productive operations in the electrical manufacturing plants of the country received by the ELECTRICAL WORLD indicate that the present peak of production in the industry was reached in December and that January production was about 5.3 per cent under December, after corrections for number of actual working days are made. The January productive operations, however, were about 8.6 per cent above those of January last year.

This is the first material drop in the monthly operations of the electrical manufacturing plants since July of last year. During the fall months and through December the operations of these plants exhibited a material upward trend at a rate which had never before been reached by the industry. That this upward trend in production attained its peak in December is indicated by the January figures. A very similar downward turn in production was witnessed in January, 1926, which would seem to indicate that a slight curtailment of production in the electrical manufacturing plants is to be normally expected during January, probably extending on into February. Such is the picture of production operations in the electrical manufacturing plants based on consumption of electrical energy by a large portion of such plants.

This slight recession in productive activities was contrary to production operations in general industry during the same month. General industry during January was operating at 4.4 per cent over December but about 5 per cent under January of last year. The rolling mills and the iron and steel mills were operating at about 3.6 per cent above December, textile plants were about on a level with December but about 7 per cent above the operations of January last year, and the automobile manufacturing plants reported operations about 45 per cent above those of December. The electrical manufacturing plants, therefore, while reporting somewhat curtailed operations during January, were producing materially above January of last year, owing in large part to the growth in the operations of the electric light and power branch of the electrical industry.

Data Unadjusted for Seasonal Variation



International Inspectors' Association Planned

At a preliminary organization meeting held on Monday of last week the first step was taken to outline a proposed method whereby an International Association of Electrical Inspectors could be formed to include the United States and Canada. The object of the association would be to unify the efforts of state, municipal and underwriting inspectors concerned with interior wiring and in the adoption and administration of standard methods. The membership that would be affected by such an association would be over one thousand who are active in inspection work and

about one thousand associate and other members.

The temporary organization formed consisted of J. C. Forsyth, president of the Eastern Association of Electrical Inspectors, president, and F. D. Weber, secretary of the Northwest Association of Electrical Inspectors, Portland, Ore., secretary. The other members present at the meeting were: T. H. Day, past-president of the Eastern Association of Electrical Inspectors; C. W. Mitchell, secretary of the California Association of Electrical Inspectors; S. S. Hertz, a member of the board of directors of the Eastern Association of Electrical Inspectors; A. G. Hall, a member of the executive committee of the Western Association of Electrical Inspectors and chief inspector of the Hydro-Electric Commission of Canada; John W. Kelly, Jr., Camden, N. J., affiliated with the International Association of Municipal Electrical Inspectors; J. S. Mahan, Chicago, member of the executive committee, and William S. Boyd, Chicago, secretary of the Western Association of Electrical Inspectors; K. W. Adkins, Missouri Inspection Bureau, St. Louis; W. J. Canada, field secretary National Fire Protection Association; Victor H. Tousley, Chicago, affiliated with the Western Association of Electrical Inspectors; William P. Briggs, New Bedford, Mass., a member of the executive committee of the Western Association of Electrical Inspectors, and E. W. Benz, West New York, N. J., secretary of the International Association of Municipal Electrical Inspectors.

Secretary Weber and Victor Tousley were appointed to draft a tentative constitution which will be sent to each representative in the temporary organization formed in order that they may present it to their individual associations, which will pass upon the formation of an international association of inspectors and the adoption of a constitution therefore.

Business Conditions

SALES are diversified and in steady volume in the electrical industry. At present manufacturers are booking orders in larger volume than their shipments, and in general factory production is at a lower point than was the case in January. Motor sales are in good volume, and industrial plant buying is active. Textile mills have placed several orders in the southeast. One such order calls for $100,000 worth of motors, and another mill bought $45,000 worth of motors and $13,000 worth of transformers and switchboard apparatus. In the same territory orders are anticipated at an early date for two 19,000-kva. waterwheel generators and transformers, involving $300,000, and a 15,000-kw. turbo-generator unit.

In New England sales are steady and central-station orders for supplies and equipment are increasing. Industrial-plant buying is active and equipment for industrial electric heating is much in demand. Central-station buying is steady but in small volume in the New York district. A large order for pole-line hardware was placed, and industrial plant buying continues fair. A material quickening of activities is noticed in the Southeast, and industrial plant buying was particularly strong. Bookings in the St. Louis district exceed shipments, and manufacturers say sales are diversified and in satisfactory quantity. On the Pacific Coast industrial plants are active buyers. A large inquiry for suspension insulators was placed by a power company.

Copper and Zinc Prices Stiffen—Good Volume of Business

The copper and zinc markets have been active despite the holiday, and prices of these metals are stronger. Speculative buying of zinc has been the feature, rather than heavy buying on the part of consumers. Only one comparatively small sale of copper brought less than 13 cents. Most of the business was confined to last week Saturday and Monday. Foreign business by the export association was excellent.

The volume of lead sales was not so large as in either of the two preceding weeks. The American Smelting & Refining Company continues its contract price at 7.40 cents and apparently made free offerings at that level for February and March shipment. Small tonnages were booked by other sellers at from 7.50 to 7.55 cents for positions further forward in most instances. Customers are well supplied for February requirenemts, most of the demand being for March shipment. Sales by Middle Western producers have been somewhat greater than production, and this has led to increased firmness. The tin market has been spotty, with some consumers buying on the rise, but dealers have been the principal ones interested in nearby metal.

NEW YORK METAL MARKET PRICES

	Feb. 16, 1927 Cents per Pound	Feb. 23, 1927 Cents per Pound
Copper electrolytic	12.925	13¼
Lead, Am. S. & R. price	7.40	7.40
Antimony	14¼	14½
Nickel, ingot	35	35
Zinc spots	7	7.15-7.17½
Tin, Straits	69	69.875
Aluminum, 99 per cent.	26	26

Base copper price Feb. 23, 1927, 15 cents.

Quickening Activity Noted in Southeast

A material quickening of activities has been noticed in the Southeast. Purchases by industrial plants were the outstanding feature. One order was placed for $100,000 worth of motors going into a new textile mill in north Georgia. Several orders will be placed at an early date by the same mill for wire and cable. Another textile mill placed orders for motors amounting to $45,000 and transformers and switchboard apparatus totaling $13,000 for a unit that is being electrified. A third mill is expected to place sizable orders in the near future for electrical construction materials for a new unit.

No large central-station orders were received, but one large order in immediate prospect covers two 19,000-kva. waterwheel generators and transformers totaling approximately $300,000. Quotations have been submitted on a 15,000-kw. turbine, and an order for this installation is expected to materialize shortly. Purchases of meters and distribution transformers continue steady, and a large number of small orders for line-construction materials are sustaining the general volume in this line. An order for $6,000 worth of poles was placed.

Bookings in St. Louis District Exceed Shipments

Manufacturers in the St. Louis district have been booking orders in all departments in greater volume than their shipments. While there has been no very large orders the sales of all kinds of electrical apparatus have been regular and in quantities quite satisfactory. Shipments of medium-sized generators, motors, switchboard equipment and transformers have continued steadily to the southwestern section of this district. Estimates have been submitted by manufacturers on some large substation equipment for local industrial concerns, but contracts are not yet closed.

Industrial Plants Active Buyers on Pacific Coast

Power-company business on the Pacific Coast covered orders for four carloads of 40-ft. poles for the Sacramento district, one carload of 12-ft. pole stubs, 100 line switches rated at 100 amp., 7,500 volts, and miscellaneous pole-line hardware. An outstanding inquiry called for 30,000 suspension-type 11,000-volt high-tension insulators valued at $80,000. Railroad buying consisted mainly of car-wiring equipment. Industrial plant orders are excellent and included $4,000 worth of lead-covered park cable for a lumber company, $2,000 worth of reflectors for an oil company, two carloads of 35-ft. and 40-ft. poles for a water company, 25 assorted oil-well double-rated motors, one 100-hp. and one 150-hp. motor for a Nevada mining company, eight motors for a northern California lumber company, and 20 assorted motors for a Stockton manufacturer. Government orders included 1,500 lighting units for a hospital and a 100-hp., 2,200-volt slow-speed pumping motor.

Three 2,000-kva., 110,000-volt transformers were purchased by the Puget Sound Power & Light Company, and the city of Seattle has placed a contract for 70,000 lb. of weatherproof wire involving $10,100. Several motor sales were made to industrial plants and included eighteen units for a plywood mill at Aberdeen, several thousand dollars' worth for a packing plant in the same town, and some motors for pulp mills at Everett, Anacortes and Bellingham. Further orders have been received for pumps and motors for irrigation districts.

Steady Sales Mark Trade in New England District

Central-station orders for supplies and equipment in the New England district are increasing and negotiations are receiving much attention. A number of substation expansions projected involve transformer and line equipment. Activity is reported by manufacturers of small switches, and the demand for insulators, line hardware and cable is good. Industrial equipment departments are active with many inquiries, and small-motor sales are steady and compare favorably with the volume of last year. Industrial electric lighting and school lighting are attracting much attention.

Industrial electric heating is active, with three manufacturers recording unusual sales. One company reports fifteen notable shipments, including two interesting foreign orders, so far this year. Summing up the market conditions, a prominent manufacturer says that in his opinion hydro-electric plant development throughout the district has reached a halt, but, on the other hand, line extensions are in order and much activity is in view. Industrial business, he says, is strong and new equipment and replacements for factory and mill power may be expected. The jobbing situation is promising.

Utility Buying Steady, but Volume Small in New York District

Public utility buying in the New York district is steady, but of small volume, and transformer sales have fallen off. One manufacturer reports that sales of transformers so far this year exceed the volume for the same period last year. Poles and cross-arms are steady in price, but buying is inactive. One manufacturer of line hardware reports a fair volume of sales, including one order for 300,000 tons placed last week, and in addition says that last month's business was considerably better than that of January last year. Sales of circuit breakers and switching equipment are inactive, and one company states that sales of switching equipment are at a lower level than they have been for several years. Industrial-plant buying continues fair, with a good demand for motors and control equipment of the smaller sizes.

Activities of the Trade

States Company Reports Good Year During 1926

Reports of last year's business from the States Company, Hartford, Conn., show that 1926 sales were the best in the organization's history. Bookings of meter testing equipment exceeded those of 1925 by 12 per cent. H. N. Porter, sales manager, states that the company's foreign business reached about the same total in each of the last two years. Recent sales to India, Australia, Japan, South America and New Zealand presage well for the year now under way. The factory is very busy and the demand for time switches has increased substantially of late. Considerable development work has now been brought to a point where the announcement of new and improved products will shortly be made.

American Jobbers' Supply Company Elects New Officers

The American Jobbers' Supply Company, 1502 Woolworth Building, New York, held its annual stockholders' meeting at Wallington, N. J., on Feb. 17 and elected the following directors and officers, following the resignation of H. C. Law, formerly secretary and manager: B. S. Handwork, president; T. C. Brown, vice-president; R. C. Boozer, treasurer, and H. E. Burns, secretary and manager. Mr. Brown will have complete charge of all high-tension insulator sales, and Mr. Burns will have charge of the sales of poles, cross-arms and pole-line construction material and will be in charge of the office. The American Jobbers' Supply Company is affiliated with the Joslyn Manufacturing & Supply Company of Chicago, being its direct and exclusive selling organization in the East, and it also represents the Porcelain Insulator Corporation, Lima, N. Y., manufacturer of high-tension porcelain insulators, and the Seyler Manufacturing Company, Pittsburgh, manufacturer of pole-line hardware.

American Metallurgical Reports Orders for Electric Furnaces

The American Metallurgical Corporation, Boston, reports increasing activity in industrial electric heating and records a number of orders of striking interest because of the diversity of application in industry of the electric heating furnace. Among the orders are noted the following: Hall-Will Company, 15-kw. box type; Reed Manufacturing Company, 60-kw. pot; Barber-Colman Company, 75-kw. box; American Seating Company, 30-kw. pot; Dodge Bros., five 30-kw. pots; Union Hardware Company, two 75-kw. boxes; Ithaca Gun Company, 20-kw. pot; Hookless Fastener Company, 75-kw. box; Keystone Manufacturing Company, 30-kw. pot; Greenfield Tap & Die Company, units aggregating 190 kw.; Aluminum Industries, Inc., 30-kw. pot and 75-kw. box; Stevens Waldren-Worcester, Inc., 30-kw. pot; Thompson Products Company, 60-kw. pot; American Saw & Manufacturing Company, 40-kw. box; Taft Pierce Manufacturing Company, 20-kw. pot, and the Goodell Company, 15-kw. box. Foreign orders received by the company recently reported cover one 60-kw. box-type furnace for C. O. Oberg & Company, Estilstuna, Sweden, and one 20-kw. pot-type furnace for Manufacturers' Femu, S. A., Palma de Mallorca, Spain.

Frank E. Kane, Inc., 109 East Twenty-ninth Street, New York City, has succeeded to the asbestos-fiber business formerly conducted by Charles W. Kane, 321 Stuyvesant Avenue, Brooklyn, and 1 Madison Avenue, New York City. For the past 35 years Charles W. Kane has acted as agent for the Clayton Paving Company, with mines at Gainesville, Ga., and has dealt in asbestos fiber.

The Locke Insulator Corporation, Charles and Cromwell Streets, Baltimore, manufacturer of high-tension insulators, is having plans drawn for a new addition, 40 ft. x 85 ft.

The Safety Cable Company, West First Street, Bayonne, N. J., has taken out a permit for a new one-story addition to its plant estimated to cost about $25,000.

The Hill Clutch Machine & Foundry Company, Cleveland, manufacturer of power transmission equipment, has recently appointed Charles C. Phelps, 473 Getty Avenue, Paterson, N. J., as its sales engineer for the metropolitan New York and northern New Jersey district.

The Page & Hill Company, 814 Plymouth Building, Minneapolis, producer of Northern white and Western red cedar poles, announces that James K. Hill has been made district manager with headquarters at Kansas City, Mo. Mr. Hill was formerly at the general offices of the company at Minneapolis.

The Blaw-Knox Company, Pittsburgh, announces that John C. White, president of the Arrowhead Iron Works of Pennsylvania, Inc., has joined the organization as sales manager of the steel grating and flooring department. Mr. White will be located at the general offices of the company at Pittsburgh.

The Hevi Duty Electric Company, Milwaukee, manufacturer of electric furnaces, announces the appointment of the Louis C. Eitzen Company, 280 Broadway, New York City, as its Eastern sales representatives. R. L. Fearn, who for many years has been active in the electric furnace field, is affiliated with the Eitzen company as a specialist on industrial electric furnaces.

The Electric Power Equipment Corporation, 412 North Eighteenth Street, Philadelphia, manufacturer of switching equipment, announces that F. T. Masterson, 401 Donovan Building, Detroit, formerly associated with A. L. Searles, representing the Electric Power Equipment Corporation and several other electrical and mechanical manufacturers, will now represent the company exclusively in the State of Michigan and part of Indiana.

The Harriman Power Plant Corporation, Torrington, Conn., plans to start manufacturing a newly designed oil-burning engine for use in power plants. The company is headed by George V. Harriman of New York, inventor of the machine. Other officers are W. W. Mertz, vice-president; R. MacCorquodale, secretary and treasurer, and Joseph H. Morehead, assistant secretary and treasurer.

The Davis System of Emergency Equipment, 67 Wall Street, New York, formerly the First Aid Specialty Company, Inc., announces that Ralph Bloomsburg, formerly chief engineer

of the Utilities Mutual Insurance Company of New York, has been made vice-president and will look after the sales of the company's product in the New England and North Atlantic states. The company also announces that D. W. Clanton, formerly safety engineer for the Georgia Power Company, has joined the organization and will look after sales in Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi and Tennessee. Mr. Clanton will be located at Atlanta.

The Commonwealth Electric Company, 417 Broadway, Saint Paul, Minn., announces that it is now manufacturing a concrete insert adaptable for most classes of light work. The insert is driven directly into the forms, no nails being required.

The Bodine Electric Company, 2254 West Ohio Street, Chicago, manufacturer of motors and electrical specialties, has plans nearing completion for two new additions, one and two-story, 20 ft. by 50 ft. and 95 ft. by 120 ft.

The John A. Roebling's Sons Company, Trenton, N. J., is now constructing a main office on South Broad Street, Trenton, which will permit of co-ordinating the executive offices, now in various buildings.

General Plastics, Inc., Tonawanda, N. Y., manufacturer of "Durez," a synthetic plastic molding compound, announces the opening of a Chicago office at 9 South Clinton Street, with Thomas A. Ryan as manager.

The James R. Kearney Corporation, 4224 Clayton Avenue, St. Louis, manufacturer of overhead and underground utility equipment, announces the following additions to its sales organization: The Oscar H. Davidson Equipment Company, 1633 Fremont Avenue, Denver, now represents the company in the Denver territory; L. Brandenburger, 149 West Second South Street, Salt Lake City, Utah, will cover the Utah and Arizona territory; Theodore B. Dally, 30 Church Street, New York City, is district representative in the New York and New Jersey territory; E. C. Dwelle, Room 1401, Allen Building, Dallas, is district representative in Texas and Louisiana; H. C. Fiske, assistant engineer of the corporation has been transferred to Atlanta as district representative in the Southeast territory, and George A. Ackerman, 658 Victor Road, Erie, Pa., has been appointed district representative in the Pittsburgh territory, covering Pennsylvania, Ohio and part of New York.

The Rockbestos Products Corporation, New Haven, Conn., manufacturer of asbestos covered wires and cables, announces the opening of its own sales office in the Union Trust Building, Pittsburgh. J. S. Rashba, formerly sales engineer with the corporation, will be in charge of this office. The company also announces that Ford W. Allen, formerly with the Garfield Manufacturing Company, has been made assistant to O. D. Allen, manager of the Chicago office.

The Johnson Manufacturing Company, Atlanta, manufacturer of live-line tools, insulator testing devices and air-break switches, announces that Paul N. Pittenger was recently appointed district representative to cover Alabama, Mississippi, Arkansas and Louisiana, with offices at 852 Brown-Marx Building, Birmingham.

The Allen-Bradley Company, Milwaukee, manufacturer of electric control apparatus, announces the opening of a district office in Detroit. J. A. White, formerly manager of the electrical department of the Charles A. Strelinger Company of Detroit, has been appointed district manager. The company also announces that George F. Pain, formerly manager of the electrical department of the Baltimore branch of the Fairbanks-Morse Company, has been appointed district manager of the Philadelphia office at 421 Bulletin Building.

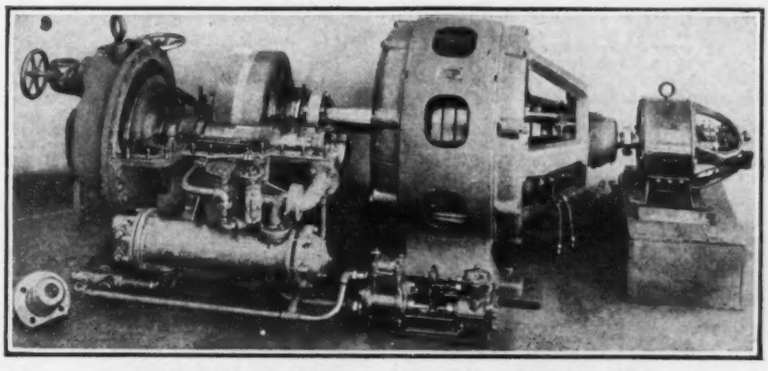
The Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, announces the appointment of the following distributors for "Adamant" firebrick and firebrick cement: The Southern Steel & Cement Company, Asheville, N. C.; the Henry A. Petter Supply Company, Paducah, Ky.; the Columbia Supply Company, 823 West Gervais Street, Columbia, S. C., and the Spartanburg Mill Supply Company, 218 Ezell Street, Spartanburg, S. C.

New Equipment Available

Gear Turbine Unit

Turbine units of the geared turbine type in ratings from 75 kw. to 500 kw. have been placed on the market by the Westinghouse Electric & Manufacturing Company. These turbines, although primarily intended for driving either alternating-current or direct-current generators, may be used to drive practically any apparatus operating at speeds within the range for which the gears are suited. The manufacturers state that these units are compact but accessible, that they are built to withstand the hardest service with a minimum of operating attention and that their steam consumption rate is excellent. The oil-operated governor used is similar to that used on larger Westinghouse turbines and makes it possible for the operator to vary the speed over a wide range while the turbine is in operation.

Space requirements have been decreased by incorporating the turbine and gear in a single casing. The turbine rotor, the blading of which is of the single-row re-entry type, is overhung on the end of the pinion shaft. This arrangement simplifies the design by eliminating all the turbine bearings and one of the glands, as well as the coupling between the turbine and pinion. The turbine when used with a generator is so designed that the unit may be mounted directly on the foundation, thus eliminating the heavy cast-iron bedplate usually required. The steam chest is mounted directly on the foundation at the side of the turbine. This protects the cylinder casing from having strains imposed upon it by the steam piping. A restraining ring gives the operator the assurance of personal safety in case of accidental extreme overspeeding, because it prevents bursting of the turbine cylinder. This safety feature is provided in addition to the standard overspeed safety governor. The reduction gear is of double helical construction designed so that the same amount of tooth surface is in contact at all times between the gear and pinion.



GEARED TURBINE UNIT WITH OVERHANGING IMPELLER

Anchoring Method for Jointless Furnace Lining Walls

The "flexo-anchor," a device that allows a one-piece monolithic furnace wall to move in any direction with expansion and contraction, providing for the difference in expansion and contraction between the common brick and the refractory lining, has been placed on the market by the Plibrico Jointless Firebrick Company, Chicago. At the same time, this device is said to anchor the refractory to the common brick wall and so effectually prevents bulging. The company states that patents covering this new anchor have been applied for. The new anchor can be used in both new settings and repair jobs. The hook is secured in the common brick wall, or, in the case of old brickwork, a brick is pried loose, the hook is inserted into the wall, and the brick is firmly wedged back into place. Then as the wall of plastic "Plibrico" is built up the anchor is placed over the hook, and as the wall rises the anchor is embedded in the "Plibrico" furnace lining.

New Trade Publications

AUTOMATIC TIMING SWITCHES AND CONTROL CABINETS.—Bulletin No. 221 issued by the Crouse-Hinds Company, Syracuse, N. Y., covers its type "B" automatic variable timing switches and control cabinets.

CONTROL RELAYS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing leaflet L-2033-A covering its types 30-C, 40-C and S-1 control relays for operation on direct current.

INSTRUCTIONS FOR SELLING LAMPS.—The National Lamp Works of the General Electric Company, Nela Park, Cleveland, is distributing its "Four Star Book" for 1927, containing instructions for its agents and for merchandising electric lamps. It gives a complete outline of its consumer advertising for the year, offers practical suggestions for tying in with this advertising and building up lamp sales, and shows what it has in the way of material to assist the agents in merchandising lamps properly.

PLATES FOR OUTLETS.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing catalog pages 66a to 66d, covering the new Hubbell bakelite outlet plates.

SIGNAL EQUIPMENT.—Bulletin No. 60-29-A issued by Charles Cory & Son, Inc., 183 Varick Street, New York, covers the Cory annunciators, bells, buzzers and signal equipment for United States Navy, merchant marine, central stations, factories, hotels, hospitals and other marine and industrial service.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Cairo, Egypt (No. 24,164), for storage batteries.

Purchase or agency is desired in Glasgow, Scotland (No. 24,188), for electrical cooking appliances, kitchen, catering equipment and service-room appliances.

Purchase is desired in Richmond, Australia (No. 24,189), of electrical floor surfacing and polishing machines.

An agency is desired in Winnipeg, Canada (No. 24,162), for cheap electric irons.

Purchase is desired in Riga, Latvia (No. 24,165), of watt-hour meters.

Purchase is desired in Valparaiso, Chile (No. 24,050), of electrically operated refrigerating equipment to hold 1,000 kilos of fish.

An agency is desired in Brussels, Belgium (No. 24,133), for scientific instruments, and measuring, controlling and precision apparatus.

An agency is desired in Vancouver, Canada (No. 24,131), for scientific instruments.

Purchase and agency are desired in Berlin, Germany (No. 24,140), for electrical novelties.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FORT KENT, ME.—Plans are under way by the International Paper Company, 100 East Forty-second Street, New York, for the construction of a new mill in the vicinity of Fort Kent, including a hydro-electric development. The cost of the entire project is estimated at about $1,000,000.

NANTUCKET, MASS.—The Citizens Gas, Electric & Power Company contemplates extensions to its power house, to cost about $40,000.

DANBURY, CONN.—An extension of the ornamental lighting system from Granville Avenue to the Danbury Normal School is under consideration.

MERIDEN, CONN.—The installation of automatic electric traffic signals at various intersections throughout the city is under consideration by the City Council. C. P. Prann, is city engineer.

Middle Atlantic States

BROOKLYN, N. Y.—The Rubel Coal & Ice Corporation, Glenmore Avenue and Junius Street, has acquired the plant of the Ebling Brewery Company in the Bronx, which it plans to remodel for an ice-manufacturing plant.

OAKS CORNERS, N. Y.—The residents of Oaks Corners have petitioned the Town Board of Phelps for the establishment of a lighting district at Oaks Corners.

ROCHESTER, N. Y.—Plans are being prepared by the Upton Cold Storage Company, 38 Cliff Street, for rebuilding its cold storage and refrigerating plant, recently destroyed by fire. The cost is estimated at $1,000,000.

JERSEY CITY, N. J.—Plans have been prepared by the Merchants Refrigerating Corporation, 17 Varick Street, New York, for a cold storage and refrigerating plant in Jersey City, to cost about $100,000.

SOMERVILLE, N. J.—The Bridgewater Township Committee is considering establishing a new lighting district in Washington Valley.

ECONOMY, PA.—A portion of the plant of the Standard Seamless Tube Company was recently damaged by fire, including the machine shops and electrical department, causing a loss of about $350,000.

ROCHESTER, PA.—The Guarantee Liquid Measure Company is taking bids for the construction of a power house and office building, to cost about $150,000. A. Blackstone is engineer.

DOVER, DEL.—Plans have been approved by the City Council for furnishing service from the municipal power plant to Little Creek, about 4 miles distant. A transmission line will be built.

HUNDRED, W. VA.—The West Penn-Monongahela Electric Company, Fairmont, plans to build a power plant in Hundred, to cost about $45,000. Extensions will be made in transmission lines.

MOUNDSVILLE, W. VA.—The City Council plans to install an ornamental lighting system in the business district.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until March 1 for a quantity of wire and cable for eastern and western yards (Schedule 6826); also, for storage batteries for eastern and western yards (Schedule 6828).

North Central States

DETROIT, MICH.—Plans have been announced for the interconnection of the Detroit (Mich.) Edison Company and the Consumers Power Company, which will include the erection of a 132,000-volt transmission line between Ypsilanti and Jackson, 60 miles long. Rights-of-way have been obtained for the new line and work will begin at once. Under the plans agreed upon each company will erect suitable substations at terminals of the new line, and a company to be known as Electrical Interconnections, Inc., has been organized which will build, own and operate a section of the line, 24 miles in length, from Saline Township to Cement City. The Detroit Edison Company will build a substation at Superior, near Ypsilanti, and install three 120,000/140,000-volt transformers. From this substation the Detroit Edison Company will erect a steel-tower transmission line between Saline and Bridgewater Townships, a distance of about 18 miles. This line will be built to handle two three-phase copper transmission circuits, only one of which will be erected at the present time. From Cement City to Jackson the transmission line, 24 miles long, similar in all respects, will be owned and built by the Consumers Power Company. North of Jackson a steel outdoor substation will be built by the Consumers Power Company, which will be equipped with three 10,000-kva. transformers, with a voltage of 140,000/120,000. This station will be the terminus of the 140,000-volt lines from the north and west which form the Consumers Power Company's main system. Bulk electricity will be distributed from this station. Alex Dow, president of the Detroit Edison Company, is president of the Electrical Interconnections, Inc.

BOWLING GREEN, OHIO.—The board of trustees of the Bowling Green State Normal School have requested an appropriation of $875,000 for extensions and improvements for the school, of which $60,000 will be used for improvements and equipment of power house, and $60,000 for tunnels, and pipe lines for heating, sewage and water systems.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 4 for valves and fittings, and street-lighting fixtures for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 4 for furnishing warnings beacons and standards for the division of traffic, Department of Public Safety.

DAYTON, OHIO.—Plans are under way by the Cincinnati, Hamilton & Dayton Railroad Company, for reconditioning track between Dayton and Cincinnati, building new substations, remodeling car barn at Moraine City, near Dayton, purchasing new electric passenger cars, etc., to cost about $700,000.

DOVER, OHIO.—Bids will be received by the Board of Control until March 15 for construction of addition to the municipal electric light plant. The cost is estimated at $100,000.

CHICAGO, ILL.—Plans are under way by the Wabash Avenue Association for the installation of an ornamental lighting system on Wabash Avenue between Harrison and Lake Streets.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul Railroad Company plans to expend $1,000,000 for improvements, of which $75,000 will be used for additions to roads, telegraph and telephone systems.

EVANSTON, ILL.—The City Council has authorized plans for an improved street-lighting system. The Randolph-Perkins Company, 38 South Dearborn Street, Chicago, is engineer.

OAK PARK, ILL.—Plans are being prepared for an ornamental lighting system, comprising about 3,700 standards to be maintained by underground wires, to cost about $500,000. The Randolph-Perkins Company, 38 South Dearborn Street, Chicago, is engineer.

CLINTONVILLE, WIS.—Property owners have petitioned the City Council for an installation of ornamental lamps on Eleventh Street.

LA CROSSE, WIS.—Plans are under way by the Trustees of La Crosse Lutheran Hospital for the installation of new equipment in the power plant at the hospital, including a coal conveyor system. Merman & Skogstad, La Crosse, are engineers.

ST. PAUL, MINN.—The installation of the proposed lighting systems on Snelling Avenue, and on West Seventh Street, have been abandoned for the present.

ONAWA, IOWA.—The purchase of a 450-kw. generating unit, to cost about $25,000, has been authorized for the municipal electric light plant.

CLINTON, MO.—Application has been made by the Arkansas-Missouri Power Company, Blytheville, Ark., for the purchase of the West Missouri Power Company, Pleasant Hill. The merged company will be known as the Missouri Public Service Company. The application states that the program for improvements in connection with the deal calls for an expenditure of about $852,000. The plans provide doubling the capacity of the local power plant of West Missouri Power Company, and the erection of a high-tension transmission line from Clinton to Pleasant Hill, etc.

ST. LOUIS, MO.—Improvements contemplated by the Union Electric Light & Power Company during 1927, involve an expenditure of about $14,000,000, and will include an addition to the Cahokia power plant on the Mississippi River, south of East St. Louis, Ill., to cost $7,900,000, of which $4,000,000 will be spent this year; about $1,000,000 will be used in the utilization of the power plant at Venice, Ill., recently purchased from the Illinois Power & Light Corporation; this plant will be connected with the Cahokia plant by a 66,000-volt transmission line now under construction; new substations and line extensions in St. Louis, will cost about $3,000,000; improvements will be made to the plant at Second and Lawrence Streets, substations will also be erected at Grand Boulevard and on Morgan Street and in the northeastern section of the city, the latter site has not been selected.

MANDAN, N. D.—Plans are being prepared by the Northern Pacific Railway Company, St. Paul, for the construction of

a power plant at its local yards, to cost about $100,000. O. M. Rognan, 1223 Railroad Building, St. Paul, is engineer.

WILLOW LAKE, S. D.—The voters have approved the sale of the municipal electric plant to the Northwestern Public Service Company, Huron, and also a franchise granting the company permission to furnish power to the town. The company will erect a transmission line from Henry to supply electricity for local service.

GRAND ISLAND, NEB.—Arrangements have been made by the Central Power Company, Grand Island, and the Southern Nebraska Power Company, Superior, whereby the latter will purchase energy from the former. Work will soon begin on the erection of a 33,000-volt transmission line by the Central Power Company from Riverside to Harvard. The Southern Nebraska Power Company will build a line from Clay Center to Harvard, which will connect the two large plants.

CONCORDIA, KAN.—The Kansas Power Company plans to rebuild its power station recently damaged by fire, with loss of about $50,000.

Southern States

ASHEVILLE, N. C.—The installation of street lamps on Dorchester Avenue is under consideration.

SPRUCE PINE, N. C.—The Carolina Power & Light Company, Raleigh, plans to extend its transmission line from Marshall to Spruce Pine, where it has taken over the electric distribution system.

SWANSEA, S. C.—The Broad River Power Company, Columbia, which has acquired the municipal electric plant, plans to erect a transmission line in this section for local service.

ATLANTA, GA.—The Georgia Railway & Power Company will erect a 2,300-volt, three-phase distribution system in Temple.

BUCHANAN, GA.—The City Council has authorized plans for the installation of an improved street-lighting system.

MIAMI, FLA.—Plans are being considered by John C. Crossland, head of the Miami Fish & Ice Company, to build a cold storage and refrigerating plant. Two buildings will be erected with a Diesel engine driven power plant. The cost is estimated at about $800,000.

ELIZABETHTON, TENN.—The installation of a new ornamental lighting system is under consideration.

BAYOU LA BATRE, ALA.—Permission has been granted by the Public Service Commission to the Bayou La Batre Power & Ice Company to construct and operate an electric generating plant in Bayou La Batre and to erect a transmission line from here to Coden.

BIRMINGHAM, ALA.—The City Commission is planning extensions in the street-lighting system.

BLUE MOUNTAIN, ALA.—The Alabama Power Company, Birmingham, has contracted with the Linen Thread Company for additional power supply at its mill, and plans extensions in substation equipment.

DECATUR, ALA.—Plans are under way by the Alabama Power Company, Birmingham, to erect a new 110,000-volt primary substation to have a capacity of 7,500 kw. A location in the vicinity of the Connecticut Mills has been tentatively selected for the new plant, power for which will be taken from the 110,000-volt line connecting Huntsville and Sheffield.

GREENVILLE, ALA.—The installation of ornamental lamps on Commerce Street is under consideration.

WHITE CLIFFS, ARK.—Plans for the proposed local cement mill to be erected by the Lime Products Company, Home Insurance Building, Little Rock, to cost about $400,000, include a power plant. The Lund Engineering Company, Home Insurance Building, Little Rock, is engineer.

OKLAHOMA CITY, OKLA.—Plans have been prepared by the Oklahoma Gas & Electric Company for the erection of a 33,000-volt transmission line from McCloud to Newalla and Marion, a distance of 20 miles, to cost about $60,000. The Byllesby Engineering Company, 231 South La Salle Street, Chicago, is engineer.

BRENHAM, TEX.—The Texas Public Utilities Company, Dallas, plans a local substation, to cost about $20,000.

TEXARKANA, TEX.—The Texarkana Electric Company, recently organized, plans to distribute electricity in Texarkana. C. A. Couch and C. V. Fisher are interested in the project.

SAN ANGELO, TEX.—The West Texas Utilities Company, Abilene, plans to erect a 66,000-volt transmission line from San Angelo to Texon, 90 miles long, to cost about $315,000. Substations, it is understood, will be erected at Tankersley, Sherwood, Mertzon and Barnhart.

Pacific and Mountain States

CAMAS, WASH.—Plans are being prepared by the City Council for the installation of an ornamental lighting system on Clark and Fourth Streets, consisting of about forty-six one-lamp standards. Stevens & Koon, Spaulding Building, Portland, Ore., are engineers.

TACOMA, WASH.—Four additional applications have been filed by the city of Tacoma with the State Hydraulics Office covering a two-million dollar development on Lake Kapowsin, 35 miles southeast of the city, to be completed in three years. The project will require several diversion dams in addition to the dam for impounding the 50,000 acre-feet of water to be stored. The latter dam to be of solid concrete construction and will be 50 ft. high and 1,750 ft. long.

ALHAMBRA, CAL.—The City Council is considering a petition for the installation of ornamental lamps in the district near the Midwick Country Club. H. E. Blake is city engineer.

LONG BEACH, CAL.—The City Council has authorized the installation of ornamental lamps on Redondo Avenue.

LOS ANGELES, CAL.—The City Council has authorized the installation of ornamental lamps on Pico Boulevard and Hobart Boulevard, using pressed steel standards. The Council is also considering the installation of ornamental lamps on Fourteenth Street and Crest Drive.

SALINAS, CAL.—Plans are under consideration by the Salinas Cold Storage & Ice Company for extensions to its plant, to cost about $150,000.

SAN BERNARDINO, CAL.—The City Council is considering the installation of ornamental lamps on Mount Vernon Avenue.

SAN FRANCISCO, CAL.—The construction program of the Great Western Power Company of San Francisco, the San Joaquin Light & Power Corporation and the Midland Counties Public Service Corporation, subsidiaries of the North American Company of New York, calls for an expenditure of $12,000,000. Of this amount $8,307,135 is apportioned to the Great Western Power Company, and provides for the erection of a 220,000-volt steel-tower transmission line, 100 miles long, from the Brighton substation, near Sacramento to the Bucks Creek generating plant of the Feather River Power Company; the construction of new roads around Lake Almanor, completion of the Chester causeway across the upper end of the reservoir, new substations and distribution lines throughout the territory, while plans are being completed for additional generating plants and increasing the generating capacity of present plants. The budget for construction work is $4,122,485 for the San Joaquin Light & Power Corporation, Fresno, and includes substantial improvements to the steam power plant at Pakersfield and numerous substations and the erection of many new lines into territory which has heretofore been without electrical service. Office buildings will be erected at Corcoran and Los Banos. The budget for the Midland Counties Public Service Corporation, San Luis Obispo, is $403,170 for construction work. This company buys its power from the San Joaquin Corporation. The work will consist chiefly in line extensions, new substations and enlarging present substations.

SAN JOSE, CAL.—The installation of ornamental lamps on about ten blocks, to cost about $35,000, is under consideration. W. Popp is city engineer.

PIERCE, IDAHO.—The Morrow Light & Power Company has applied for permission to build a hydro-electric plant on Orofino Creek to supply electricity at Pierce, Weippe and vicinity.

TUCSON, ARIZ.—The City Council has plans nearing completion for the construction of an ornamental lighting system on North Sixth Street, from Congress Street, to the speedway. George T. Grove is city engineer.

HANOVER, MONT.—Plans are under consideration by the Three Forks Portland Cement Company, Ideal Building, Denver, for the installation of substation equipment at its local plant, in connection with the construction of an electric haulage line between the mill and quarry, about 4½ miles. The cost of the entire project is estimated at $250,000.

DENVER, COL.—Bids will be received at the office of the Bureau of Reclamation, Denver, until March 15 for furnishing one hydraulic turbine to deliver 3,400 hp. under a 65-ft. head, one 102-in. butterfly valve, one 3,000-kva. generator, three 1,000-kva. transformers, switching apparatus, six 37,000-volt disconnecting switches, and one 37,000-volt oil-circuit breaker, for the Guernsey power plant, North Platte project, Nebraska-Wyoming.

Canada

SELKIRK, MAN.—Plans for the proposed pulp and paper mill to be erected by the Backus-Brooks Company, Builders' Exchange, Minneapolis, Minn., on the Red River, near Selkirk, to cost about $1,500,000, include a power plant.

SAULT STE MARIE, ONT.—An organization has been formed under the name of the Citizens' Hydro-Electric Committee, with the Mayor as chairman. Its purpose is to bring about under public ownership the development of 25,000 hp. on the Montreal River and 100,000 hp. on the Mississauga River. The Ontario Hydro-Electric Power Commission will be asked to take up the matter and furnish estimates.

SAULT STE MARIE, ONT.—Plans are being considered by the Algoma District Power Company for the installation of an additional 2,000 hp. unit in its plant at Michipicoten Falls. A preliminary survey is under way by engineers of the company for a further development of the falls, for making available the full capacity of the falls.

TORONTO, ONT.—Plans are under consideration for enlarging the Toronto General Hospital, to cost about $2,500,000. The work will include radiology and pathological buildings, power house and work shop, enlarging present main buildings tunnels from power house and between buildings, etc.

SHAWINIGAN FALLS, QUE.—The Electric Service Corporation plans to erect a transmission line in Daveluyville, St. Raphael and Maddington Parishes, 16 miles long, to cost about $40,000. J. Bourgeois, Jr., Shawinigan Falls, is engineer. The company also plans to erect a new steel-tower transmission line to St. Martin, to cost about $50,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Jan. 25, 1927)

1,615,685. MAGNETIC CORE; W. Ehlers, Berlin Grunau, Germany. App. filed March 14, 1925. A magnetic core formed of a compressed mixture of magnetic material and insulating material, and having in the densest portions thereof a relatively greater proportion of insulating material than the proportions which are less dense.

1,615,686. METHOD OF WELDING; O. H. Eschholz, Wilkinsburg, Pa. App. filed Sept. 28, 1921. A method of forming arc deposits for welds and joints.

1,615,687. AUTOMATIC ARC-WELDING APPARATUS: O. H. Eschholz, Beaver, Pa. App. filed March 17, 1924. A fusible metal arc-welding system in which the feed of the electrode is controlled automatically.

1,615,688. METERING SYSTEM; R. D. Evans, Pittsburgh, Pa. App. filed Dec. 7, 1921. Measurement of the unbalanced load in an electrical circuit.

1,615,691. MEASURING SYSTEM; C. L. Fortescue and R. D. Evans, Pittsburgh, Pa. App. filed Jan. 7, 1922. The measurement of the unbalanced load in an electrical circuit.

1,615,693. CONTROL APPARATUS; A. Giannasi, Richmond, Va. App. filed Sept. 23, 1924. A drum controller that is so constructed as to eliminate destructive arcing at the contact members.

1,615,704. METER-TESTING SWITCH MECHANISM; O. S. Jennings, Brooklyn, N. Y. App. filed March 23, 1921.

1,615,726. ELECTRICAL PLUG SYSTEM; W. Row, Melbourne, Victoria, Australia. App. filed Nov. 2, 1925. Of the type used in theaters and concert halls for rapidly switching stage-lighting circuits into use or for quickly changing over to different lighting circuits to obtain varying stage-lighting effects.

1,615,731. ELECTRIC METER; R. A. Warner, Schenectady, N. Y. App. filed Sept. 7, 1923. For simultaneously measuring both the watt and wattless component of a polyphase alternating-current circuit.

1,614,742. ELECTRICAL HEATING APPARATUS; G. H. Collins and H. F. Collins, Birmingham, England. App. filed July 1, 1925. Safety cut-out for electrically heated appliances, more particularly for electric kettles and liquid heating domestic utensils.

1,615,766. VIBRATORY CONVERTER; O. M. Leich, Genoa, Ill. App. filed Nov. 21, 1921. A converter adapted to feed two different circuits from a transformer having a single primary winding.

1,615,767. ELECTRICAL BRAKE; H. V. McCormick, Cincinnati, Ohio. App. filed Feb. 25, 1924. Wherein fluid means may be employed for retarding the otherwise rapid movement of the armature associated with such brake apparatus.

1,615,788. ELECTRIC FUSE OR CIRCUIT-TESTING DEVICE; F. A. Feldkamp, Newark, N. J. App. filed Jan. 6, 1922.

1,615,800. METHOD OF AND APPARATUS FOR MAKING INSULATORS; G. M. Eaton Wilkinsburg, Pa. App. filed Aug. 6, 1923.

1,615,817. SWITCH BOX; H. K. Krantz, Brooklyn, N. Y. App. filed Sept. 8, 1920. Such as are used for enclosing entrance switches commonly employed in lighting and power circuits.

(Issued Feb. 1, 1927)

1,615,819. ELECTRIC WATER HEATER; L. W. Armstrong, Las Animas, Col. App. filed March 29, 1926. Immersion type.

1,615,839. PRIMARY GALVANIC CELL AND ELECTRODE THEREFOR; G. W. Heise, Bayside, N. Y., and E. A. Schumacher, Brooklyn, N. Y. App. filed Feb. 1, 1924.

1,615,950. ELECTRIC HEATER; W. F. Long, Grand Haven, Mich. App. filed May 11, 1925. An electric heating element which may be used in many places, as in a device for heating curling irons, electric toasters, small electric stoves and the like.

1,615,957. SINTERING REFRACTORY METALS; E. E. Schumacher, East Orange, N. J. App. filed Oct. 2, 1923.

1,615,983. MOUNTING VACUUM BULBS; C. G. Jones, New York, N. Y. App. filed July 15, 1921. The mounting of vacuum thermocouple bulbs.

1,615,995. ELECTRIC ARC FOR MELTING AND PULVERIZING METALS; W. Muller, Tarragona, Spain. App. filed Jan. 24, 1924.

1,616,000. ELECTRIC SNAP SWITCH; A. E. Raque, Jersey City, N. J. App. filed Jan. 28, 1925. Rapid make-and-break switching mechanism of high-amperage capacity.

1,616,001. HIGH-FREQUENCY LAMP; H. C. Rentschlet, East Orange, N. J. App. filed Feb. 21, 1923. For use in concentrating light upon an object, as in motion-picture projectors.

1,616,044. METHOD OF CONTROLLING THE DISTRIBUTION OF ELECTRIC DISCHARGES; E. L. Harrington, Saskatoon, Saskatchewan, Canada. App. filed March 22, 1921.

1,616,067. ELONGATED ELECTRICALLY HEATED OVEN; H. E. Somes, Philipse Manor, N. Y. App. filed April 7, 1924. Of the tunnel type, through which objects are passed from end to end and subjected therein to heated air or other heated gases.

1,616,145. METHOD OF ELECTRIC ARC WELDING; R. L. Shipman, Trumbull, Conn. App. filed Dec. 11, 1925.

1,616,148. MULTIPLE FUSE; C. E. Stoltz, St. Louis, Mo. App. filed April 16, 1925.

1,616,149. CONTROLLER HOUSING; J. Teipel and W. F. Exner, St. Louis, Mo. App. filed Oct. 26, 1922. Flameproof.

1,616,174. METERING PANELBOARD; G. W. Berthold, Chicago, Ill. App. filed Oct. 30, 1922.

1,616,180. ELECTROMAGNETIC DEVICE; F. E. Field, Somerville, N. J. App. filed Dec. 28, 1921. Means for controlling the reasonance frequency of such devices.

1,616,207. ELECTROMAGNET SPOOL; J. W. Wardell, Sugar, Utah. App. filed Jan. 16, 1925.

1,616,230. ELECTRIC SPEED-REGULATING APPARATUS; W. S. Richmond, Buffalo, N. Y. App. filed Nov. 3, 1921. By which changes in the characteristics of the electrical energy supplied to a circuit, such, for example, as those affecting the impedance of the circuit, may be utilized to operate automatically regulating or governing mechanisms for controlling the speed of prime movers and other machines.

1,616,277. ELECTRIC SWITCH; H. H. Osborn, Chicago, Ill. App. filed July 17, 1922. With means for positively and sharply throwing a switch blade from one button to another and for positively locking the blade in contact with any button to which it is turned.

1,616,307. THERMAL CONTROLLER FOR INCUBATORS; J. E. Davis, Cambridge, Iowa. App. filed Nov. 20, 1922.

1,616,309. LUMINOUS ELECTRIC SIGN; F. H. Eeles and H. M. Duchard, Paris, France. App. filed Feb. 16, 1925.

1,616,360. RACK; W. Foster, Philadelphia, Pa. App. filed April 14, 1926. Secondary rack.

1,616,387. RESISTANCE MEASUREMENT; C. E. Perry, Chiswick, London, England. App. filed Jan. 4, 1926. Measurement of the resistance of electrolytes. A process for the continuous measurement of the resistance of condensates.

(Issued Feb. 8, 1927)

16,540 (reissue). SYNCHRONIZING DEVICE; O. C. Traver, Schenectady, N. Y. App. filed July 29, 1922.

16,548 (reissue). STORAGE-BATTERY CELL AND THE LIKE; J. Waddell, Bakewell, England. App. filed Feb. 8, 1921. Glass wool, which consists of a yielding mass of very fine filaments, is employed for separating the plates.

1,616,448. ELECTROLYTIC SYSTEM FOR PROTECTION OF CONDENSERS, TANKS AND SUCH LIKE VESSELS AGAINST CORROSION; A. S. Gush and M. C. Gush, Hove, England. App. filed Feb. 3, 1925.

1,616,465. NOISELESS CLOCK MECHANISM; E. S. Ostler, Chicago, Ill. App. filed May 11, 1925. Controlled by an intermittently energized electromagnet.

1,616,528. PLURAL LAMP SOCKET; J. S. Cuming, St. Louis, Mo. App. filed Feb. 21, 1921.

1,616,585. STORAGE-BATTERY MANUFACTURE; J. M. Lea, Detroit, Mich. App. filed Aug. 1, 1921. Batteries of the lead-sulphuric-acid type. Process for treating pasted battery elements.

1,616,604. TRAFFIC SIGNAL; J. P. Brophy, Cleveland, Ohio. App. filed Sept. 16, 1926. Adapted to be mounted at street intersections to indicate direction of traffic movement.

1,616,615. STORAGE-CELL COVER; W. K. Fleming and A. M. Baehr, Lakewood, Ohio. App. filed March 19, 1923. For use in "B" battery.

1,616,658. MULTIPLE-UNIT ELECTRIC TRANSMISSION; J. A. Heany, New Haven, Conn. App. filed April 15, 1920. Of the multiple-unit type wherein two or more dynamo-electric machines are utilized to transmit power from a prime mover or driving member to a driven member. Automatic means for electrically connecting the two units when the required torque exceeds the capacity of the first unit.

1,616,684. MOTOR CONTROLLER; C. T. Evans, Wauwatosa, Wis. App. filed June 8, 1925. Compensator starter for induction motors.

1,616,722. KROMAYER-LIGHT ATTACHMENT; F. G. Vernon, Merrill, Iowa. App. filed June 12, 1926. A nosepiece or a chimney attachable to a mercury quartz-lens lamp used in treating the inner membrane lining of the nose.

1,616,754. GALVANOMETER; R. Mechau, Jena, Germany. App. filed Sept. 29, 1921. Sensitive in the highest possible degree especially to mechanical strains, concussions or the like.

1,616,760. CONTROLLER FOR MOTOR-DRIVEN MACHINES OF THE MULTI-UNIT TYPE; T. H. Rodman, New York, N. Y. App. filed June 18, 1923. Particularly applicable to multi-unit newspaper presses.

1,616,764. INSULATOR CHANGER; J. G. Simmons, Marion, Ill. App. filed Aug. 13, 1923.

1,616,771. FUSE PLUG; L. Vecchio, Schenectady, N. Y. App. filed Jan. 4, 1922. Renewable.

1,616,794, 1,616,795. POLYPHASE-DISTANT-CONTROL SYSTEM FOR DIFFERENTIAL TRANSMISSION; E. Granat, Paris, France. Apps. filed April 6 and Sept. 14, 1925.

1,616,796, 1,616,797, 1,616,798. ELECTRIC FURNACE; A. E. Greene, Seattle, Wash. Apps. filed Feb. 18, 1919, March 5 and Oct. 23, 1923. Electrode holder in the form of a vertically operating trolley engaging the surfaces of a vertical I-beam with an insulated electrode clamp adapted to hold an electrode on the end of the trolley arm.

1,616,801. LIGHTNING ROD; A. G. Hoovens, Goshen, Ind. App. filed Aug. 18, 1921.

1,616,809. RAILWAY-CROSSING SIGNAL; M. A. Kuhn, Porterville, Cal., and G. D. Gebhart, Reedley, Cal. App. filed April 11, 1925.

1,616,847. GROUND CLAMP; A. E. Feige, Hackensack, N. J. App. filed May 5, 1925.

1,616,879. SIGNALING MECHANISM; N. H. Suren, Needham, Mass. App. filed Dec. 7, 1920. For use in auxiliary fire-alarm-signal initiating stations.

1,616,945. PROTECTIVE DEVICE FOR ELECTRIC SWITCHBOARDS; G. W. Ashlock, Jr., Oakland, Cal. App. filed June 25, 1923. Dead-front construction.

1,617,040. SNAP SWITCH; P. H. Zimmer, Jackson, Mich. App. filed Oct. 22, 1925.

1,617,065. INTERMITTENT GLOW LAMP; C. F. Lorenz, East Orange, N. J. App. filed March 17, 1923. A glow lamp which may automatically operate to effect alternately a contact and a separation of the cathode and the anode.

1,617,092. INDUCTION SYNCHRONOUS MOTOR; T. Yamamoto, Takata-Machi, Japan, and M. Kawarada, Nipporicho, Japan. App. filed July 1, 1922. Accomplished by uniting an induction motor with a direct-current series generator. By providing a high-resistance squirrel-cage winding, which may also serve as wedges, the torque speed characteristic during the accelerating stage can be made substantially equal to that of Boucherot's double-squirrel-cage type.

1,617,097. PULL-SWITCH SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 26, 1920.

1,617,130. REGULATING SYSTEM; G. R. McDonald, Schenectady, N. Y. App. filed March 23, 1926. For use in controlling the division of the load between a plurality of overcompounded generators connected in parallel.

1,617,136. ELECTRODE DEVICE FOR ELECTRIC FURNACES; O. Sandvold, O. Rye and O. Platou, Notodden, Norway. App. filed Nov. 27, 1925.

1,617,138. ELECTRIC HEATER FOR WAVING OR CURLING THE HAIR; E. F. Suter, London, England. App. filed July 9, 1925.

1,617,145. SHUNT; C. G. Brown, Schenectady, N. Y. App. filed Jan. 6, 1925. Variable-ratio electric shunt suitable for use in connection with an electric measuring instrument to determine voltage and current values.

1,617,151. REGENERATIVE BRAKING CONTROL; P. W. Forsberg, Schenectady, N. Y. App. filed June 2, 1926. Means for initiating and regulating the braking operation of the motors.

1,617,154. INSULATOR; M. F. Gouverneur, Rochester, N. Y. App. filed July 29, 1919. Means for connecting the hardware to the porcelain body portion of a suspension-insulator unit.

1,617,157. ELECTROTHERAPEUTICAL DEVICE; W. J. Herdman, Toronto, Ontario, Canada. App. filed Aug. 31, 1922. Employs high-frequency electricity as the curative agent.

1,617,217. ELECTRIC CLOCK; B. Newth and O. Newth, Sydney, New South Wales, Australia. App. filed Nov. 26, 1923. Substituting the energy in an electric battery for that contained in wound springs.

1,617,218. ELECTRIC BATTERY FOR CLOCKS; B. Newth and O. Newth, Sydney, New South Wales, Australia. App. filed June 4, 1925.

1,617,224. METHOD OF UNITING METAL SECTIONS; P. W. Shaw, Lynn, Mass. App. filed Dec. 24, 1923.

1,617,230. ELECTRIC CELL; S. Apostoloff, Brooklyn, N. Y. App. filed Sept. 6, 1924. Of the Leclanché type provided with a depolarizing mass or body comprising "activated" carbon or carbon of the "decolorizing-carbon" type.

1,617,247. RELAY; W. D. Hailes, Rochester, N. Y. App. filed Sept. 15, 1924. Polyphase alternating-current relay of the vane type.

1,617,314. SERIES-OPERATED STUDIO ARC LAMPS; T. Hall, Brooklyn, N. Y. App. filed May 20, 1920.